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# NAVAL POSTGRADUATE SCHOOL

## Monterey, California



W65122

# THESIS

AN ECONOMIC ANALYSIS  
OF  
MILITARY EXPENDITURES

by

Anthony Lee Winns  
o o o

December, 1989

Thesis Co-Advisors: William R. Gates, William J. Walsh

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An Economic Analysis  
of  
Military Expenditures

by

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Submitted in partial fulfillment  
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

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December 1989

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Department of Administrative Sciences

## **ABSTRACT**

This thesis empirically explores the nature of the relationships between members of formal and informal alliances. A pooled time series cross sectional data methodology is employed to analyze those factors believed to have a significant impact on the behavior of national governments in allotting funds for defense. Regression analysis is performed on seventy-five countries over an eleven year period (1974-1984) including both NATO and non-NATO members; communist and non-communist nations; and developed and less-developed countries. The empirical results reveal inconclusive evidence for the traditional view that an inverse relationship exists between the military expenditures of allies. The distinction between formal and informal allies provides no further evidence of support and exposes some of the weaknesses of this view of military alliances.

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## **I. INTRODUCTION**

### **A. OBJECTIVE**

The purpose of this research is to test the explanatory power of factors that are likely to have a significant influence on the defense spending of our allies and rivals. The factors that will be tested for their degree of impact on military expenditures include: gross national product (GNP), military expenditures of formal and informal allies, military expenditures of rival countries, social expenditures, and constraints on military expenditures imposed by treaty or constitution. These factors were selected as potentially important determinants of defense spending after a thorough examination of both the theoretical literature and prior empirical research.

This thesis topic is designed as an extension of a project completed by Dr. Stephen L. Mehay and Dr. Rodolfo A. Gonzalez, "An Economic Model of the Supply of Military Output," April 1987, Naval Postgraduate School, Monterey, CA. Their project utilized the theory of bureaucracy to analyze the collective choice mechanism for determining a country's military spending. Spillover effects on a nation's military spending from its allies and rivals were investigated for one year of data (1982).

This study conducts an analysis similar to their research, but differs in two ways. First, the sample consists of data over an eleven year period, 1974 -1985. Second, and even more important, this study directly tests the extent of free riding behavior occurring among formal allies and allies who are not members of formal alliances.

The primary purpose for testing for relationships between a nation's military expenditures and the defense spending of her allies and rivals is to develop a regression model that accurately predicts the behavior of national governments in allotting funds for defense. Additionally, this research provides an understanding of some of the factors that have the greatest impact on the military expenditure of a nation.

The data base for this study was developed from selected data contained in the *World Military Expenditure and Arms Transfer* manual developed by The U.S. Arms Control and Disarmament Agency, Washington, D.C., 1986.

## **B. BACKGROUND**

This thesis capitalizes on many of the same measures and methodologies employed in the work of Dr. Mehay and Dr. Gonzalez. Both studies utilize regression analysis techniques for testing the individual data bases to develop optimal models.

Dr. Mehay and Dr. Gonzalez used income, population, social spending, political structure, volunteer force, and spending limitations to test for a nation's military spending. Their model integrated economies of size in military output from both the consumption (publicness) and production (scale) sides. This study is similar and builds on their concepts by introducing more variables believed to have a significant impact on a country's defense spending. Specifically, a distinction is made between a formal ally and an informal ally. The end result is an improved model.

Their research discovered that while economies of size to national defense appear to be important for western nations, they appear to be lacking in less developed countries. This difference was thought to be due in part to the different weapons mix

between the two samples. The weapons mix among the western nations is weighted toward deterrent weapons, but in comparison the less developed nations tend to favor conventional forces and protective weapons.

The study completed by Dr. Mehay and Dr. Gonzalez resulted in a specific regression model to explore an alternative decision making model that takes into account autonomous preferences by government decision makers. Because only one year of data was used and no distinction was made between formal and informal allies, this may have negatively impacted the performance of their model.

### C. PUBLIC GOOD

As in prior studies of defense expenditures, it is assumed that defense services exhibit to a significant degree the characteristics of a public good. Public goods are goods which are jointly consumed by individuals.

The notion of a pure public good is germane to this study and must be formally defined. Todd Sandler, in his article entitled "Sharing Burdens in NATO," offers the following definition:

A good is a pure public good when its benefits are nonrival and non-excludable. The benefits of a good are nonrival whenever a unit of the good can be consumed by one agent without detracting, in the slightest, from the consumption opportunities still available to others from the same unit. Benefits that are available to all agents once the good is provided are termed nonexcludable. [Ref. 1:p. 30]

Examples of public goods include firework displays, national defense, pollution-control devices and street lighting. More than one person can simultaneously benefit from the above goods without diminishing the value of the good to others, and it is



virtually impossible to exclude any individual from consuming the good once it is provided.

#### **D. THE SUBSTITUTION EFFECT**

When the price of a good rises, *ceteris paribus*, the consumer is usually affected in two principal ways. First, the consumer's real income or purchasing power is reduced, because the higher price reduces the amount of commodities that can be purchased. In addition, the price increase makes the good a relatively poorer bargain compared to its substitutes, so the consumer substitutes other goods that are cheaper in place of the now more expensive one. This second response is called the substitution effect. [Ref. 2:p. 75]

Mancur Olson Jr. and Richard Zeckhauser (1966) assume that the output of an ally is a substitute good. They were among the first to argue that the pure public good nature of national defense and differences in member size led to larger members bearing a disproportionate share of the burden of the common defense of an alliance. In other words, it was predicted that the smaller allies would free ride by relying on the contributions of the larger allies for protection. The term free rider in this context means that a country contributes less than her derived benefits would warrant.

#### **E. THESIS ORGANIZATION**

Chapter II reviews the various theories developed to help explain the defense expenditure of a nation. This chapter describes the theory and assumptions presented by Mancur Olson Jr. and Richard Zeckhauser. The non-cooperative model of Olson and Zeckhauser has provided the theoretical basis for many subsequent studies and

alternative views. Some of those alternative views, such as those argued by Todd Sandler and his colleagues, are presented.

Chapter III discusses the model used to test the theoretical hypothesis. All variables are fully explained and the problems, methodology, assumptions and procedures for testing the data base are discussed. The model is very similar to the one used by Dr. Mehay and Dr. Gonzalez in their study.

Chapter IV describes the sample selection and data collection procedures employed in developing the data base. A list of the countries included in the analysis and the rationale for their selection to certain sample groups is discussed. The table of allies and rivals is constructed for all seventy-five countries included in this study.

Chapter V details the data analysis procedures used to test specific hypotheses. The statistical tests address the central research question: Is there an inverse relationship between a nation's military expenditure and that of its allies. Regression models were constructed to separately address the central research question in the context of various subsets of the data base.

Chapter VI presents a summary of the results, the final conclusions and recommendations.

## **II. THEORETICAL REVIEW OF MILITARY EXPENDITURES**

### **A. FRAMEWORK**

Economic analyses of a nation's military output have been organized around two distinct but related lines of reasoning. The first approach, argued by Mancur Olson Jr. and Richard Zeckhauser in 1966, focuses on the pure public good attribute of national defense and discusses the free-riding behavior of smaller nations on large, defense-producing nations. They suggest that the bureaucracy of formalized (military) alliances creates recurring situations which make smaller nations unwilling to contribute to the common defense in proportion to the share of benefits they receive. As a result, the smaller nations force the larger ones to take on more of the organization's military requirements. These larger, industrialized nations therefore bear a disproportionate share of the burden.

The second line of reasoning has been based primarily on the studies of Todd Sandler and his colleagues. Their approach argues that NATO defense activities produce different types of weapons depending on the degree of publicness. In other words, military alliances produce a mix of outputs, some of which are not purely public. Their reasoning suggests that some defense expenditures will induce complementary behavior among alliance nations rather than the substitution effects envisioned by the Olson and Zeckhauser model.

## 1. General Qualifications

An important point often neglected in the burden sharing debate is that efficiency requires a balance of contributions and benefits. In other words, there should be a balance between the percent of a nation's contribution and the percent of benefit received.

Ideally, what we would like to measure is total contribution relative to total benefit. However, since it is difficult to accurately measure benefits, it is assumed that GNP or GNP per capita can be used as a proxy (e.g., benefit from security is measured by the wealth one stands to lose). Additionally, one assumes that total contribution can be measured by defense expenditures. Using expenditures and GNP only indicates whether there is free riding if both of these assumptions are true. If there are other benefits (i.e., American drive for superiority, force projection, economic spillovers, etc.) or other types of contributions (i.e., land, facilities, inconvenience to population, etc.) then these measurements do not adequately measure the presence of free riding. Both of these assumptions are adopted by convention for this analysis.

Another implicit assumption throughout the discussion on military expenditures is that there should be proportional sharing of the defense burden in an alliance. In other words, expenditures should be proportional rather than based on sacrifice. However, this is contrary to the U.S. income tax scheme which says that sacrifice should be proportional. If this were true, one would expect wealthier nations to contribute more (assuming diminishing marginal utility of income or wealth). As well, many less wealthy countries might be bearing more than their share of sacrifice.



## **B. THE FIRST LINE OF INQUIRY**

In the mid-1960's, Olson and Zeckhauser postulated a clever hypothesis to explain the disproportionate burden sharing observed among countries in the NATO alliance. The NATO group was chosen because of its large amount of resources and because it provided adequate data to test the implications of their model. They argued that U.S. strategic nuclear weapons provided mostly public benefits that were nonrival to the allies and also nonexcludable. That is, the nuclear deterrence provided by the U.S. arsenal could underwrite the security of the other allies without diminishing the deterrence provided to the United States itself.

When allies contribute toward an arsenal whose benefits are shared by all without regard to payment, smaller allies have an incentive to ride free by relying on the contributions of the larger allies for protection. Such selfish behavior allows the free rider to spend its scarce resources on other things. Thus, the shared defense benefits provided by a nation's allies are equivalent to an increase in the nation's income.

In great depth, the Olson and Zeckhauser argument purports to explain how, from an economic vantage point, alliances operate. Its primary focus is on the NATO countries, although the model utilized can be applied to other alliances. Measured as either a percentage of their GNP or a percentage of their government budgets, smaller nations expend significantly less of their budgets toward defense than do larger member nations. If GNP is used as a proxy for the benefits of national security, the larger countries contribute more than their proportionate share to the alliance while the smaller nations contribute less in comparison to the benefits they derive. According to Olson and Zeckhauser, their research proved that there was a significant "positive

correlation" between the size of a member's national income and the percentage of its national income devoted to the common defense [Ref. 3:p. 277].

In a similar manner, it has been noted that the alliance does not adequately fulfill its own established quota of military division requirements. The facts usually indicate that it is the smaller nations that do not supply the necessary resources to meet their quota requirements. The United States' contribution has increased beyond its quota to balance the deficiency of other alliance members. Of course, this simply causes some participants to benefit from their alliance membership without paying their dues. As a result, the independence of the group is threatened due to the disproportionate expenditure of resources by the larger nations in contrast to the smaller nations' contributions.

There are various reasons to help explain this occurrence. Perhaps there exists an American drive for superiority and dominance based on moral supremacy. Another reason is obviously linked to how member nations manage and allot their resources to meet such requirements. Clearly, the answer to NATO's disproportionality problem and why it is not fully equipped to satisfy its own preestablished charter lies in the bosom of how much (and why) these member nations give to the whole organization.

Throughout the discussion and analysis presented by Olson and Zeckhauser, it is assumed that there will always be some degree of disproportionality involved. However, there is one important case where they believe there will be no tendency toward disproportionality. This would occur if defense became a superior good. A superior good is one where expenditures on the good increases by as much or more than income increases. Applying this definition to military spending, all of the increase

in income that a nation receives in the form of defense provided by allies is spent on defense goods. In other words, as a nation gets more free defense from an ally, it would not reduce its own military expenditure.

This special case could be an important one. Olson and Zeckhauser offer the following: "During periods of all-out war or exceptional insecurity, it is likely that defense is (or is nearly) a superior good, and in such circumstances alliances will not have any tendency toward disproportionate burden sharing." [Ref. 3:p. 271]

Olson and Zeckhauser further argue that the defense output of allies yields a collective security (public) good which is shared equally by all alliance members, but whose production level depends on the separate expenditure decisions of each ally. Each nation is assumed to choose its defense output without considering the spillover effects its decisions have on the other members.

One rational explanation for this behavior stems from the concept of suboptimality. As they (Olson and Zeckhauser) view alliance interactions, there will always be a suboptimal amount of defense produced. In other words, even though a specific amount of defense can be obtained from the collective contributions of alliance nations, the collective effort will fall short of the optimal amount. It must be emphasized that efficiency requires a balance of contributions and benefits. It is best said by Olson and Zeckhauser [Ref. 3:p. 271]:

Although there is then one exception to the rule that alliance burdens are shared disproportionately, there is no equivalent exception to the rule that alliances provide suboptimal amounts of the collective good. The alliance output will always be suboptimal so long as the members of the alliance place a positive value on additional units of defense. This is because each of the alliance members contributes to the point where its marginal rate of substitution for the good equals the marginal cost of the good...There could be an optimal quantity of the collective good only if the total value which all of the alliance members



together placed on an additional unit of the good equalled marginal cost,...The individual nations in an alliance would have an incentive to keep providing additional alliance forces until the Pareto-optimal level is reached only if there were an arrangement such that the alliance members shared marginal costs in the same proportions in which they shared additional benefits (that is, in the same ratio as their marginal rates of substitution of money for the good). When there is such a marginal cost sharing scheme, there need be no tendency toward disproportionality in the sharing of burdens.

According to Olson and Zeckhauser, one possible solution to the problem of disproportionality and suboptimality is institutional changes that alter the pattern of incentives. Suboptimal decision-making is a common characteristic of large organizations. The vehicle, therefore, to change this outcome would be to change policies. From this manipulation, it is possible that less of a disproportionate share of the burden would be carried by the large, defense producing nations. Also according to Olson and Zeckhauser, these policy changes "...at least have the merit that they help to make the national interests of individual nations more nearly compatible with the efficient attainment of the goals which groups of nations hold in common." [Ref. 3:p. 279]

Another plausible solution to the problem is to harness the "differences of purpose" that already exist in an alliance or international organization. The model implies that alliances and international organizations will not work efficiently regardless of how complete the agreement and "community of interest" among the members. Some differences of purpose increase the private, non-collective benefits and in doing so they improve the working of the alliance. For example, many European NATO members probably would have smaller military forces and contribute less to NATO if it were not for their private interests and fears. In viewing the long-term effect, these



differences will alleviate the suboptimality and disproportionality problems and improve the alliance. [Ref. 3:p. 279]

In another respect, part of the solution is in the analysis of why and how such organizations exist. Olson and Zeckhauser [Ref. 3:p. 267] state that one purpose that all such organizations must have is that of serving the common interests of member states. In the case of NATO, the proclaimed purpose of the alliance is to protect the member nations from aggression by a common enemy. The combined defense effort of these countries contributes to the common defense of the group. Hence, we have a collective consumption situation. Olson and Zeckhauser describe its characteristics:

Such a common objective is a collective good, since it has one or both of the following properties: (1) if the common goal is achieved, everyone who shares this goal automatically benefits, or in other words, nonpurchasers cannot feasibly be kept from consuming the good, and (2) if the good is available to any one person in a group it is or can be made available to the other members of the group at little or no marginal cost. [Ref. 3:p. 267]

Critical to the first line of reasoning is the idea that an individual member acting apart from the group usually has no incentive to provide optimal amounts of such goods. Where the group interested in a public good is very large, and the share of the total benefit that goes to any single individual is very small, usually no individual has an incentive voluntarily to purchase any of the good [Ref. 3:p. 267]. In the case where the group is small, members will usually have an incentive to provide for the collective good, and to make appropriate sacrifices to do so, but usually they will tend to provide only suboptimal amounts of this good. "There will also be a tendency for the larger members - those that place a higher absolute value on the public good - to bear a disproportionate share of the burden...." [Ref. 3:p. 268]

Simply stated, the first line of reasoning explores the commodity or "good" of military security considering its public good characteristics. The economists, Rodolfo Gonzalez and Stephen Mehay, in their article, "An Economic Model of the Supply of Military Output," describe it this way: "Olson and Zeckhauser (1966) argued that in alliances the pure public good attribute of national defense and differences in member size combine to create free riding behavior by smaller members." [Ref. 4:p. 2] In essence, in an alliance the output of allies is a substitute for the amount a nation spends on its own defense.

### **1. Assumptions**

The Olson and Zeckhauser model revolves around the premise that countries place a specific value on national defense at the expense of other goods (nondefense) that could have been purchased. Naturally, in an alliance, the amount a nation spends on defense will be affected to some extent by the amount its allies provide. Their non-cooperative model of military alliances has several important assumptions that are critical in justifying their conclusions.

The first assumption is that defense is in fact a pure public good. As such, its enjoyment is shared by all in the alliance and it is not feasible (and sometimes not even possible) to exclude any member from consuming it. The "free rider" problem is based on this assumption.

Another assumption in the model is that all goods are "normal goods." Normal goods are goods such that if a consumer's income increases, the number of units purchased of the good also increases. However, even Olson and Zeckhauser [Ref.

3:p. 279] admit that if defense became a "superior good" such as in "all-out war or extreme insecurity," there would be no tendency toward disproportionality.

Throughout their reasoning, it is assumed that the "costs of defense are constant to scale and the same for all alliance members." [Ref. 3:p. 271] However, it is more accurate to consider that some types of weapon systems and ground forces do have rising costs. Alternatively, other weapon systems have "undoubtedly striking economies of large scale production...." [Ref. 3:p. 271] As a result, there will be differences between the defense expenditures of large and small nations on these items. Olson and Zeckhauser conclude that regardless of the differences in marginal costs among countries, the basic premises of their argument are not altered.

Although not specifically cited in the literature, an implicit assumption in their model as noted by the economists Gonzalez and Mehay [Ref. 5:p. 1] is that the output of one nation does not enhance the marginal effectiveness of the alliance output. In other words, the model completely rules out the possibility of complementarity among members' defense outputs.

Another assumption in their model is that the military forces in an alliance provide only the collective benefit of alliance security, when in fact they also provide national, non-collective benefits to the nations that maintain them [Ref. 3:p. 272]. For example, when the Soviet Union mobilized additional forces to suppress the independence movement in Angola, a national goal unrelated to the purposes of the WARSAW PACT, she simultaneously increased the total strength of the WARSAW alliance. Olson and Zeckhauser [Ref. 3:p. 272] state that "in any situations in which the military forces of alliance members provide important non-collective benefits as

well as alliance benefits, the degree of suboptimality and the importance of the disproportionality will decrease because the non-collective benefits give the member nations an incentive to maintain larger forces."

A final qualifying assumption of the model is that alliance members do not take into account the reactions of other members in their defense contributions. One reason for this behavior, according to Olson and Zeckhauser [Ref. 3:p. 273], is that alliances are often involved in situations that contain a strong element of irreversibility. A second factor is the difference between market and non-market groups [Ref. 3:p. 273]. Market groups traditionally engage in price wars or cut-throat competition to drive competitors out of the industry. However, non-market groups, such as alliances, usually strive for large membership, since the supply of the collective good increases as the membership increases.

### **C. THE SECOND LINE OF INQUIRY**

The second approach to military spending has revolved around the research of Todd Sandler and his colleagues. In contrast to the Olson and Zeckhauser non-cooperative model, Sandler developed the "joint product" model in 1977. This model emphasized a theory of military interdependence, allowing for the possibility of complementarity between the defense spending of the members of an alliance. Since the original joint product model, empirical analysis of these arguments has continued to focus on specifying demand functions for defense output.

Sandler (1980) argues that his joint product model is the most comprehensive model of alliance behavior because it includes private, impure public, and pure public outputs of defense expenditures [Ref. 6:p. 425]. Moreover, he feels that because of



changes since the Olson and Zeckhauser model (1966), the straightforward application of the pure public good model is no longer appropriate for defense alliance behavior. Sandler [Ref. 6:p. 426] states that "the change in NATO's military strategy, the development of new weapon systems, and the increase of disputes exogenous to the East-West split favor the application of the joint product model, since rivalry in consumption, multiple outputs, benefit exclusion, and private benefits are increasingly characterizing modern alliances."

Sandler and Murdoch surmise that complementarity among the joint products of the NATO members may be the result of the move away from what is called mutual assured destruction (MAD) towards the flexible response doctrine of the mid-1970's. In the latter case, NATO nations engage their security forces in multiple arenas to avoid a full-scale nuclear confrontation. It is believed that any conflict provoked by Warsaw Pact challenges will initially begin with the use of conventional and tactical weapons followed by military armament exchanges with nuclear weapons. Therefore, the perspective is of a progressive and sequential confrontation between national powers.

In this vein, no longer can NATO countries rely on nuclear weapons' deterrence to fend off security challenges. They must at a minimum be prepared to defend themselves against conventional aggression. Hence, the concept of a flexible response allows for the conventional and tactical response necessary in the early stages of a European conflict. Sandler and Murdoch offer the following:

...the nuclear and non-nuclear arsenals contribute to each other's value; they become complementary. This, therefore, implies a complementarity between the military activities of the smaller European allies and the larger nuclear nations. [Ref. 7:p. 90]



According to this view, if a member nation does not keep pace with the military activity of its allies, it could be inviting trouble. An opponent may take the opportunity to gain an advantage by creating a confrontation on that ally's territory. In this situation, of course, the conflict is considered to be conventional. Sandler and Murdoch write [Ref. 7:p. 90]:

...with strong complementarity, an ally's military activity could increase in response to greater alliance-wide military activities. In reality, the military activity of a nation is quite closely measured by its military expenditures...a NATO ally is predicted to have less desire to free ride.

The joint product approach allows for a relationship of complementarity between defense goods by introducing various defense commodities into the model. A distinction is made between strategic and conventional forces in developing this model of defense. Sandler and Forbes call attention to the fact that many nations have different mixes of weapons, each with its own degree of publicness. They describe a purely deterrent weapon as one with the sole purpose of conveying "a credible retaliatory threat on behalf of an alliance" (e.g., Trident submarines, B-1 bombers), while weapons are classified as purely protective or damage-limiting when they are deployed "to deny an enemy its military objective." [Ref. 6:p. 427] Another type of weapon is called a mixed defense weapon. This is a weapon that satisfies both deterrent and damage-limiting purposes such as multi-purpose aircraft and cruise missiles.

The model suggests that the inherently different types of weapons and the adoption of the doctrine of flexible response by NATO during the early 1970's caused a complementarity relationship among alliance members. As a result, it appears that the extent of free riding in the NATO alliance has diminished. Among NATO nations,

only a minority (Canada, Germany, Turkey, and the United Kingdom) are found to act in accordance with the free rider hypothesis advanced by Olson and Zeckhauser. [Ref. 8:p. 261]

### **1. Improving the Joint Product model**

Todd Sandler and James C. Murdoch (1982) improve and refine the joint product model so that it can better analyze nuclear war alliances. In particular, they suggest that the refined models demonstrate that allies' responses to defense spillovers depend upon the consumption relationship (i.e., complementarity or substitutability) of the jointly produced defense outputs as well as the allies' income responsiveness [Ref. 8:p. 239].

Their research is centered around a theoretical model of a nuclear war alliance. From this model, it is believed that when the jointly produced defense outputs are complementary, allies may increase their defense expenditures in response to the spill-ins from large defense producing nations. Spill-ins are the benefits received from the defense expenditures made by another ally. Furthermore, it is suggested that the stability and size of alliances are also related to the consumption relationship of the jointly produced outputs." [Ref. 8:p. 237] Finally, they present the idea that the influence of spill-ins (or spillovers) on both arsenal maintenance and the membership size of the organization can be determined and traced to the "consumption relationship of the jointly produced outputs." [Ref. 8:p. 239]

In the joint product model, an alliance is depicted "as relying upon an arsenal that provides deterrence, damage-limiting protection (needed when deterrence fails), and private benefits." [Ref. 8:p. 242] This model suggests that wealth is not the

only variable that influences the patterns in defense expenditures. Damage-limiting weapons (e.g., tanks, anti-ballistic missiles) can be partially rival in a sense between allies. Such would be the case if they are positioned along a common border. Sandler [Ref. 6:p. 427] purports that "when an arsenal of damage-limiting weapons is required to protect a larger front or boundary as a new ally joins, a thinning of forces results from a spatial rivalry which detracts from the protection of the existing allies." These weapons can be deployed elsewhere or withheld from engagement. In other words, their services (or benefits) can be excluded. According to this line of reasoning, the end-result is that the alliance enjoys "pure public (deterrence), impure public (damage-limitation forces), and private benefits." [Ref. 8:p. 242]

Sandler's theoretical analyses suggest that the military expenditures of any ally are a function of four separate factors. These include wealth, thinning, spill-ins, and strategic strength.

The first factor, wealth, is a measure of an ally's gross domestic product. Thinning, the second factor, is approximated by the ratio of an ally's military personnel to its exposed border. This variable captures the potential density of the ally's armed forces along its exposed perimeter. The third factor, spill-ins, is determined from net NATO expenditures after subtracting the ally's own defense expenditures. The last variable is the relative strategic strength of NATO. It is expressed by the ratio of U.S. long-range missiles (ICBMs and SLBMs) plus long range bombers to USSR long-range missiles and bombers.

From the results, Sandler and Murdoch predict nations will not respond positively to spill-ins when free riding is possible or when the jointly made products

of defense are substitutes. However, if the outputs are complementary, the results indicate that an ally will actually increase defense spending in reaction to the spill-ins. They believe that the flexible response doctrine will cause a complementary relationship between deterrent and damage-limiting weapons. Furthermore, this complementary relationship should be particularly prevalent for those countries that have colonial interests.

In a similar manner, Sandler and Murdoch (1984) examine some of the major factors that influence a nation's demand for military spending. Their research cites two primary findings in alliance activity among its members. The first is the "free rider" concept whereby some in the alliance contribute a greater share of their gross domestic product to military expenditures and thus carry more of a security burden. This phenomena is consistent with the Olson and Zeckhauser model and matches their description of disproportionality. The second observation made is that there have been significant changes in the shares of military expenditure over time (1960-1979). Specifically, they note that the military share gap has closed between all of the relatively large and small nations and this closing is due to the dramatic reductions in the shares of the nuclear allies. Of course this suggests that the extent of the free rider problem in the NATO alliance has diminished.

#### **D. SUMMARY**

This chapter has offered the two main views on the economic analyses of a nation's military expenditure. Olson and Zeckhauser were the first to present a public goods approach to the study of alliance behavior. They depicted NATO as sharing a pure public good in the form of deterrence. Their study showed that responses to



spill-ins only depended upon income responsiveness and that, in most situations, spill-ins caused allies to cut defense expenditures. This approach focuses on the pure public good characteristic of national defense and emphasizes the substitution effect of military expenditures in an alliance.

In contrast to this first line of inquiry, Todd Sandler and his colleagues offer a second view suggesting that when the jointly produced outputs are complementary vice substitutable, allies could increase their defense expenditures in response to spill-ins. Thus, the joint product model emphasizes the complementary effect of defense expenditures and offers the possibility of cooperative behavior among alliance nations.



### **III. THE MODEL**

#### **A. INTRODUCTION**

The model offered here attempts to portray inherently the decisions made by government executives in defense expenditures. The theory can be applied to any nation because clinically this framework targets those variables predicted to have a strong, positive impact on the outcome of military expenditures.

Analogous to the model used in the Gonzalez and Mehay research, this study assumes that there is an interaction or interdependence made among nations that are rival and among nations that are allies.

Similar to the Gonzalez and Mehay work, this model offers two primary advantages over previous economic research on national defense spending. First, the model incorporates the interdependence of military decisions between rivals as well as between allies. Secondly, prior research has concentrated on the spillover effects between allies who are members of formal alliances, generally NATO. This narrow focus omits consideration of nations that are operational allies even though they are not members of formal alliances, and includes nations who are formal but not operational allies. This research expands the scope of inquiry by investigating spillovers between nations that can be defined as operational or informal allies, regardless of whether they are members of formal alliances.

This study does not emphasize the type of good that is provided by a military alliance, but rather that the good has a significant degree of publicness and yields

benefit to all the members of the group. It is assumed that nations do not have to belong to a formal alliance for the theory to apply. Since it is assumed that deterrence is a public good, whether a country is formally participating in an alliance or not, they are the benefactors of their own defense production along with the production of other nations who they informally ally with. Olson and Zeckhauser write: "Another assumption in the model developed was that the military forces in an alliance provide only the collective benefit of alliance security, when in fact they also provide purely national, non-collective benefits to the nations that maintain them." [Ref. 3:p. 272]

It should be clear that it is also assumed that defense has an element of publicness (public good) both among members of a formal alliance and among nations informally allied. In addition, the view toward defense is comprehensive. Though the two basic research studies cited earlier discuss the issues of economies of size (consumption and production) of weaponry, this study views military spending as a whole. The issue is not the types of weapons that are produced, such as conventional versus nuclear or tactical versus strategic. Rather, the pertinent issue is when national officials make their fiscal decisions, which variables have the greatest influence on the resulting defense spending policy. The Olson and Zeckhauser model assumes that the costs of defense are constant to scale and the same for all alliance members. Although military forces are composed of different types of equipment and manpower, it is still unlikely that costs are constant and uniform. However, because the emphasis of this study is on testing for relationships between a country's military expenditure and that of its allies, the costs of defense are irrelevant and do not affect the model.

## B. THEORETICAL BASIS

There are numerous theories that have been developed and used to explain national military expenditures. The basic premise of this research is that national defense spending is a function of a nation's population (POP), income per capita (PCI), government social expenditures (SE), military expenditures of formal allies (FA), military expenditures of informal allies (IA), and the military expenditures of rival countries (RIV). Written in a theoretical formula, the following is derived:

$$ME_{it} = f(POP_{it}, PCI_{it}, SE_{t-1}, FA_{t-1}, IA_{t-1}, RIV_{t-1}). \text{ That is to say that:}$$

- $i$  = a particular nation
- $t$  = time/specific year
- $t-1$  = time lagged by one year

According to Gonzalez and Mehay [Ref. 4:p. 11], the reaction effects between allies and rivals introduce potential simultaneity into the estimation of the above formula. In addition, the construction of the variables for ally and rival spending assumes that a reciprocal relationship exists between nations identified as allies and rivals; that is, the set of nations identified as allies (or rivals) of a nation  $i$  will also have  $i$  as an ally (or rival).

However, it is questionable whether simultaneity is a serious concern in defense spending patterns across nations. It is likely any reaction effect will occur with a considerable lag since information on an ally and, especially, rival spending may not be known with certainty during a nation's budgetary cycle. This reasoning suggests that the proper specification of the above formula should incorporate lags in the ally and rival variables.

Following Murdoch and Sandler (1984), and Gonzalez and Mehay (1987), time is lagged by one year for the military expenditures of both formal and informal allies, the defense expenditures of rival countries, and government social expenditures to avoid simultaneity.

The total military expenditures by formal and informal allies of nation  $i$  are net of nation  $i$ 's military expenditures. Previous studies (i.e., Gonzalez and Mehay) have proved this to be the best technique.

A nation is considered to be a "significant" rival to country  $i$  if two conditions exist: (1) a territorial or political conflict exists between the two nations that may induce either nation to employ armed force against the other; and (2) the ability of a nation to resist an attack is not negligible. Condition (2) requires that a nation's armed forces not be simply a token force.

Similarly, a given nation is considered to be a "significant" ally to country  $i$  if two conditions hold: (1) the relationship between the two countries, formal or otherwise, is such that the nation can be relied upon to support  $i$  in an armed conflict with a third party; and (2) the nation's potential military contribution in support of  $i$  is not negligible. Memberships in formal alliances and bilateral defense treaties were used in part in designating nations as allies and rivals. However, alliances and treaties were ignored in those cases where evidence suggests that the signatories do not intend to abide by an agreement. An example of the latter is the 14 Nation Treaty among African nations.



The variable *ME* represents a nation's total military spending in year *t*. The variables *FA*, *IA*, and *RIV* are the total formal, informal, and rival military expenditures respectively of country *i* in year *t*.

A nation's gross national product (GNP) is often used as a measure of its national income. However, GNP is the product of per capita income and population. Therefore, to form a more explanatory model, the variables per capita income (*PCI*) and population (*POP*) are used as separate variables instead of combining them to form total GNP.

If national income is held constant, an obvious trade-off will exist between social and defense spending. Therefore, this study incorporates the amount of a country's social spending measured as the annual non-military central government spending. The variable social expenditures (*SE*) is calculated as the difference between a nation's central government expenditures and its military expenditures.

The tradeoff between defense and social spending should impart a negative sign to the *SE* variable. On the other hand, a positive sign for the social spending variable could provide some indication of the government's general ability to tax the electorate at a given income level.

Following the Gonzalez and Mehay study (1987), the nature of the constitutional regime could have an important effect on military spending, independent of the external military environment. This factor is controlled by including a dummy variable, *NONDEM*, which equals unity when a country is classified as either a totalitarian or authoritarian regime.



A second dummy variable, *CONSTR*, is also included to capture those nations whose military spending is constrained by treaty or constitution. This variable is set equal to unity for three nations--Finland, Japan, and Austria.

The empirical model for estimating a nation's military expenditure is converted to a log-linear (constant elasticity) form by taking the log of all the variables excluding the dummy variables. This was necessary in order to perform the required regressions.

The model is used to test the explanatory power of the independent variables against the dependent variable, military expenditures. A regression is performed over an eleven year period on seventy-five countries using a statistical procedure known as the cross-pooled regression method. Unlike a routine regression, all factors are regressed over an eleven year period for all countries resulting in one regression line. The advantage of this method over others, such as the time series regression, is that it increases the variation in the dependent and explanatory variables.

## **IV. DATA COLLECTION**

### **A. SAMPLE SELECTION**

The countries used in this study are chosen based upon the research conducted by Rodolfo Gonzalez and Stephen Mehay [Ref. 4:p. 30] in their article, "An Economic Model of the Supply of Military Output." These countries include North Atlantic Treaty Organization (NATO) members; WARSAW Treaty Organization (WTO) nations; and developed (superpowers) and less developed (Third World) countries. Additionally, a distinction is made between democratic and non-democratic nations. The underlying criteria for selecting and including these particular countries are the availability of data and the capability to detect the relationship of interdependence with other nations. This is encompassed in the bureaucratic concept argued by Gonzalez and Mehay.

Countries will participate in organizations for the purpose of obtaining a good that, without the collective benefit of their membership, they could not independently produce the same quantity or quality. Nations must and do expend the resources required to procure whatever they deem to be the requisite amount of defense, security preparation, and protection for pre-war confrontations and full-scale war engagements. It is the contention of this research that military spending is affected by the size of the country, its per capita wealth, and the defense expenditures of its allies and rivals. Olson and Zeckhauser focus on the workings of alliances, but their comments are still relevant to the discussion at hand. They write: "In an alliance, the amount a nation spends on defense will be affected by the amount its allies provide...the more defense

this nation's allies provide, the further the cost constraint decreases and the less it spends on defense...The amount of defense that this nation provides will in turn influence the defense output of its allies...." [Ref. 3:p. 268] Therefore, the nations that provide an ample spectrum of characteristic backgrounds and influences as just discussed, were chosen for this study.

## **B. DATA PRESENTATION**

The Appendix lists the 75 countries and relevant cross-sectional data selected for this research. The data covers an eleven year period, 1974-1984. Although data were collected for 141 nations, missing data for some variables reduced the usable sample to 75. The cross-sectional data utilized for this research was taken from the annual World Military Expenditures & Arms Transfer manual 1986, published by the United States Arms Control and Disarmament Agency. All data are presented in constant 1983 dollars. Variables used in Appendix A include:

- YR = calendar year
- ME = total government military expenditures in million dollars
- GE = total government expenditures in million dollars
- POP = population in millions
- PI = income per capita in dollars
- BK = country-specific designations such as NATO
- \* = data not available

Table 1 lists the relevant countries used over the eleven year period, 1974-1984, with their formal allies (FA), informal allies (IA), and rivals (RV).

## **C. QUALIFICATIONS**

The military expenditure data may be of uneven accuracy and completeness. This could be caused by the number of different sources used to obtain the data or due to

**TABLE 1****LIST OF COUNTRIES (Allies & Rivals)**

| <b>Number</b> | <b>Country Name</b>         | <b>FA</b>  | <b>IA</b> | <b>RV</b>                         |
|---------------|-----------------------------|--|-----------|-----------------------------------|
| 1.            | Argentina                   | NA   | NA        | 13,71                             |
| 2.            | Australia                   | 33,39,52,71,72   | 30,63     | 54                                |
| 3.            | Austria                     | NA   | NA        | NA                                |
| 4.            | Bangladesh                  | NA   | 25        | 43                                |
| 5.            | Belgium                     | NATO (5,12,17,<br>21,22,29,32,38,<br>41,49,55,67,71,<br>72,74) | NA        | WTO (8,15,<br>19,24,48,<br>50,54) |
| 6.            | Bolivia                     | NA   | NA        | NA                                |
| 7.            | Brazil                      | NA   | NA        | NA                                |
| 8.            | Bulgaria                    | WTO  | NA        | NATO                              |
| 9.            | Burkina Faso                | NA   | NA        | NA                                |
| 10.           | Burma                       | NA   | NA        | NA                                |
| 11.           | Cameroon                    | NA   | NA        | NA                                |
| 12.           | Canada                      | NATO   | NA        | WTO                               |
| 13.           | Chile                       | NA   | NA        | 1,46                              |
| 14.           | Colombia                    | NA   | NA        | 73                                |
| 15.           | Czechoslovakia              | WTO  | NA        | NATO                              |
| 16.           | Central African<br>Republic | NA   | NA        | NA                                |
| 17.           | Denmark                     | NATO   | NA        | WTO                               |
| 18.           | Ecuador                     | NA   | NA        | 46                                |
| 19.           | East Germany                | WTO  | NA        | NATO                              |



| Number | Country Name | FA               | IA              | RV          |
|--------|--------------|------------------|-----------------|-------------|
| 20.    | Finland      | NA               | NA              | 54          |
| 21.    | France       | NATO             | NA              | WTO         |
| 22.    | Greece       | NATO (except 67) | NA              | WTO,67      |
| 23.    | Guyana       | NA               | NA              | 73          |
| 24.    | Hungary      | WTO              | NA              | NATO        |
| 25.    | India        | NA               | 54              | 43,76       |
| 26.    | Indonesia    | NA               | 2,30            | 77          |
| 27.    | Ireland      | NA               | NA              | NA          |
| 28.    | Israel       | NA               | 72              | 54,59,78,79 |
| 29.    | Italy        | NATO             | NA              | WTO         |
| 30.    | Japan        | NA               | 2,72            | 54          |
| 31.    | Kenya        | NA               | 53,71,72,<br>80 | 54,81       |
| 32.    | Luxembourg   | NATO             | NA              | WTO         |
| 33.    | Malaysia     | 2,39,52,71       | 72              | 54,77       |
| 34.    | Mali         | NA               | NA              | NA          |
| 35.    | Malta        | NA               | NA              | NA          |
| 36.    | Mexico       | NA               | 72              | NA          |
| 37.    | Nepal        | NA               | NA              | NA          |
| 38.    | Netherlands  | NATO             | NA              | WTO         |
| 39.    | New Zealand  | 2,33,52,71,72    | NA              | 54          |
| 40.    | Nigeria      | NA               | NA              | NA          |
| 41.    | Norway       | NATO             | 57              | WTO         |

| Number | Country Name    | FA         | IA                | RV                     |
|--------|-----------------|------------|-------------------|------------------------|
| 42.    | Oman            | NA         | 70,82,83<br>84,85 | 79                     |
| 43.    | Pakistan        | NA         | 72,76             | 25,54                  |
| 44.    | Papa New Guinea | NA         | NA                | NA                     |
| 45.    | Paraguay        | NA         | NA                | NA                     |
| 46.    | Peru            | NA         | NA                | 13,18                  |
| 47.    | Philippines     | NA         | 72                | NA                     |
| 48.    | Poland          | WTO        | NA                | NATO                   |
| 49.    | Portugal        | NATO       | NA                | WTO                    |
| 50.    | Romania         | WTO        | NA                | NATO                   |
| 51.    | Senegal         | NA         | 21                | 86,87                  |
| 52.    | Singapore       | 2,33,39,71 | NA                | 77                     |
| 53.    | Somalia         | NA         | 31,72             | 81                     |
| 54.    | Soviet Union    | WTO        | 77,88,89          | NATO,2,28,<br>30,57,76 |
| 55.    | Spain           | NATO       | NA                | WTO                    |
| 56.    | Sri Lanka       | NA         | NA                | NA                     |
| 57.    | Sweden          | NA         | 41                | 54                     |
| 58.    | Switzerland     | NA         | NA                | NA                     |
| 59.    | Syria           | NA         | 54                | 28,72,90               |
| 60.    | South Africa    | NA         | NA                | 91,92                  |
| 61.    | South Korea     | NA         | 72                | 54,89                  |
| 62.    | Tanzania        | NA         | NA                | NA                     |

| Number | Country Name         | FA                  | IA                 | RV                  |
|--------|----------------------|---------------------|--------------------|---------------------|
| 63.    | Thailand             | NA                  | 2,72               | 77                  |
| 64.    | Togo                 | NA                  | NA                 | NA                  |
| 65.    | Trinidad-Tobago      | NA                  | NA                 | NA                  |
| 66.    | Tunisia              | NA                  | 21                 | 93                  |
| 67.    | Turkey               | NATO (except 22)    | NA                 | WTO,22              |
| 68.    | Uganda               | NA                  | 62                 | NA                  |
| 69.    | Uruguay              | NA                  | NA                 | NA                  |
| 70.    | United Arab Emirates | NA                  | 42,82,83,<br>84,85 | 79                  |
| 71.    | United Kingdom       | NATO,2,33,<br>39,52 | NA                 | WTO,77              |
| 72.    | United States        | NATO,2,39           | 30,28,43,<br>61,76 | WTO,59,77,<br>88,89 |
| 73.    | Venezuela            | NA                  | NA                 | 14,23               |
| 74.    | West Germany         | NATO                | NA                 | WTO                 |
| 75.    | Yugoslavia           | NA                  | NA                 | 54                  |

Note: The following countries were not in the sample but were used in computing allies/rivals:

|              |                  |             |                   |
|--------------|------------------|-------------|-------------------|
| 76. China    | 77. Vietnam      | 78. Iraq    | 79. Iran          |
| 80. Sudan    | 81. Ethiopia     | 82. Bahrain | 83. Kuwait        |
| 84. Qatar    | 85. Saudi Arabia | 86. Guinea  | 87. Guinea-Bissau |
| 88. Cuba     | 89. North Korea  | 90. Jordan  | 91. Mozambique    |
| 92. Zimbabwe | 93. Libya        |             |                   |

the recent deemphasis of the collection of such data by the Agency for International Development, a major source of data in the past. For example, there are indications or reasons to believe that the military expenditures reported by some countries (i.e., Ecuador and Syria) consist mainly or entirely of recurring or operating expenditures and omit most capital expenditures, including arms purchases.

Particular problems arise in estimating the military expenditures of communist countries due to the exceptional scarcity and ambiguity of released information. Data on Soviet military expenditures are based on Central Intelligence Agency (CIA) estimates of what it would cost in the United States in dollars to develop, procure, staff and operate a military force similar to that of the Soviet Union. These estimates are the best available; in fact, there are no alternative estimates available that can inspire equal confidence.

Unlike Western countries where statistics on the National Budget, Gross National Product, Industrial Output, Trade, Balance of Payments, etc. are accurately reported, WARSAW Pact nations treat such accounts as state secrets. This is not to say that official statistics are not published, but too frequently they are stagnant values repeated from one year to the next. To gain a true perspective of the problems, successes or failures in the various categories, Western analysts have turned to examining available data and intelligence for use in estimating the actual values.

For WARSAW Pact countries other than the Soviet Union, the estimates of military expenditures are from the publication "East European Military Expenditures," published by the Research Project on National Income in East Central Europe. These military expenditures refer only to the officially announced state budget expenditures



on national defense. Therefore, these figures understate total military expenditures in view of defense outlays by non-defense agencies of the central government, local governments, and economic enterprises. Possible subsidization of military procurement may also cause understatement. However, since the bias is consistent among the WARSAW pact countries, the effect on the statistical regression is not significant.

## V. EMPIRICAL ANALYSIS

### A. THEORETICAL HYPOTHESIS

This chapter addresses the central research question: Is there an inverse relationship between a country's military expenditure and that of its allies? The hypotheses tested are:

$H_0$ : There is no inverse relationship between a country's military expenditure and that of its formal allies. Mathematically, this is expressed as  $b_4 \geq 0$ .

$H_1$ : There is an inverse relationship between a country's military expenditure and that of its formal allies. Mathematically, this is expressed as  $b_4 < 0$  (i.e., the regression coefficient is significantly different from zero and is negative).

$H_0$ : There is no inverse relationship between a country's military expenditure and that of its informal allies. Mathematically, this is expressed as  $b_5 \geq 0$ .

$H_1$ : There is an inverse relationship between a country's military expenditure and that of its formal allies. Mathematically, this is expressed as  $b_5 < 0$  (i.e., the regression coefficient is significantly different from zero and is negative).

In the alternative hypotheses ( $H_1$ ), both  $b_4$  and  $b_5$  are stated as less than zero. This implies that their values are negative. Given these are negative and significant, and taking into account the other variables in the model, the decision maker could postulate that an inverse relationship does exist.

The values  $b_4$  and  $b_5$  in the above expressions refer to the coefficients of the variables Formal Allies and Informal Allies in the basic model. The loglinear form of the basic model is expressed as follows:

$$\log ME_{it} = b_0 + b_1 \log(POP_{it}) + b_2 \log(PCI_{it}) + b_3 \log(SE_{t-1}) + b_4 \log(FA_{t-1}) + b_5 \log(IA_{t-1}) + b_6 \log(RIV_{t-1})$$

To fully support the "free rider" theory of Olson and Zeckhauser (1966), we expect the coefficients  $b_4$  and  $b_5$  to be negative and significant. In addition,  $b_4$  should be more negative than  $b_5$ .

The level of significance is very important in any statistical analysis. The analyst must first determine how certain he or she wants to be in accepting or rejecting the null hypothesis ( $H_0$ ). In other words, the decision maker establishes the risk level he or she is willing to tolerate in terms of rejecting a true null hypothesis. If  $H_0$  is rejected when in fact it is true, a Type I error is committed. The probability of making a Type I error is given by  $\alpha$ , also called the level of significance. That is,

$$P(\text{Type I error}) = \alpha.$$

The larger the  $\alpha$ , the more likely it is that  $H_0$  will be rejected falsely. The analyst determines the size of  $\alpha$ . For example, if he wants to be 99% sure of his result, an  $\alpha = .01$  is selected; if he wants to be 95% sure, an  $\alpha = .05$  is selected. The  $\alpha$  value should always be set prior to collection of the data. For all the tests in this study, an  $\alpha = .05$  is used.

## B. THE STATISTICAL REGRESSION

Routine computer regressions were run on the full sample of seventy-five countries and on six individual subsamples over the eleven year period, 1974-1984.

The full sample was further divided into six subsamples over the same period to determine the impact that the six independent variables had on these smaller groupings of nations.

In order to establish these smaller groupings of countries, all seventy-five countries were given politico-economic labels such as LDC (less-developed country), WTO (Warsaw Treaty Organization member), Western nations (advanced market economies) or NATO (North Atlantic Treaty Organization member). The final six subsample groupings are based on these title designations and include the following: (1) NATO; (2) Western; (3) WTO; (4) LDC; (5) WTO & LDC; (6) Western & LDC.

The following countries are included in the various subsamples for this study:

NATO: United States, Netherlands, Denmark, Luxembourg, West Germany, Norway, United Kingdom, Portugal, Spain, France, Italy, Greece, Turkey, Canada, Belgium.

Western: NATO countries plus Australia, Austria, Finland, Ireland, Japan, New Zealand, Sweden, Switzerland.

WTO: Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, Soviet Union.

LDC: Argentina, Bangladesh, Bolivia, Brazil, Burkina Faso, Burma, Cameroon, Central African Republic, Chile, Colombia, Ecuador, Guyana, India, Indonesia, Israel, Kenya, Malaysia, Mali, Malta, Mexico, Nepal, Nigeria, Oman, Pakistan, Papua New Guinea, Paraguay, Peru, Philippines, Senegal, Singapore, Somalia, South Africa, South Korea, Sri Lanka, Syria, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Uganda, United Arab Emirates, Uruguay, Venezuela, Yugoslavia.

### **C. EMPIRICAL RESULTS**

For all of the regressions, the dependent variable is the log military expenditures of the countries included in the particular sample. The independent variables are logarithms of population, per capita income, social expenditures, military expenditures



of formal allies, military expenditures of informal allies, rival military expenditures, constrained (present in only some samples), and nondemocratic (present in only some samples).

In each regression a group of statistics is generated to help determine the suitability of the model and guide the researcher in his acceptance or rejection of the hypothesis. The following is a brief description of each:

$r^2$  - the coefficient of determination. This measures the proportion of variation in the dependent variable that is explained by the variation in the independent variables in the regression model.

Adj  $r^2$  - This is an adjusted value to reflect both the number of predictor or explanatory variables in the model and the sample size.

Parameter Estimate - gives an estimate for the value of the coefficients.

Standard Error - measures how much the parameter estimates would vary from one collection of data to the next. Standard errors can be used to construct confidence intervals about the parameter estimates.

T for  $H_0$  - gives the t-value for testing the null hypothesis that the parameter equals zero. These t-values are equal to the parameter estimates divided by their standard errors. They are used to test if the parameter estimates differ significantly from zero. As a general rule, if the t-value is greater than  $\pm 1.96$ , the coefficient can be accepted as significant at the .05 level.

Prob > [T] - gives the "p-value" which is the probability of observing a t-value more extreme than the t-value obtained from the regression. The p-value is extremely important because it is the "observed level of significance," the smallest level at which

$H_0$  can be rejected for a given set of data. The analyst need only compare these p-values with  $\alpha$  to determine whether or not the given variable is a significant explanatory one. If the p-value is less than  $\alpha$ ,  $H_0$  can be rejected.

F Value, Prob > F - gives the test statistic and p-value associated with a test of the hypothesis that at least one variable in the overall model explains a significant portion of the variation in the data. In other words, it allows the entire model to be tested for significance. As a general rule, if the F-statistic is greater than 5.0, the model can be accepted as statistically significant.

### **1. NATO subsample**

Table 2 shows the results of the regression analysis of the NATO countries. The adjusted  $r^2$  value indicates that 96.92 percent of the variation in the model is explained by the independent variables. Likewise, since "Prob>F" is less than the significance level of  $\alpha = .05$ , one can conclude that the regression as a whole is significant.

The variable IA is negative and significant which supports the theory of Olson and Zeckhauser. The variable FA is also negative but not significant. Therefore, their theory can not be completely supported given the regression results.

### **2. WESTERN subsample**

Table 3 shows the results of the regression analysis of the Western countries subsample. The adjusted  $r^2$  value indicates that a high percentage of the variation in the model is explained by the independent variables. Likewise, since "Prob>F" is less than the significance level of  $\alpha = .05$ , the regression as a whole appears to be significant.

TABLE 2

## NATO ANALYSIS OF VARIANCE

DEP VARIABLE: LOGME      LOG MILITARY EXPENDITURES

| SOURCE   | DF  | SUM OF<br>SQUARES | MEAN<br>SQUARE | F VALUE | PROB>F |
|----------|-----|-------------------|----------------|---------|--------|
| MODEL    | 6   | 550.55640         | 91.75940003    | 855.727 | 0.0001 |
| ERROR    | 157 | 16.83507233       | 0.10722976     |         |        |
| C TOTAL  | 163 | 567.39147         |                |         |        |
| ROOT MSE |     | 0.3274596         | R-SQUARE       | 0.9703  |        |
| DEP MEAN |     | 8.255137          | ADJ R-SQ       | 0.9692  |        |
| C.V.     |     | 3.966737          |                |         |        |

## PARAMETER ESTIMATES

| VARIABLE | DF | PARAMETER<br>ESTIMATE | STANDARD<br>ERROR | T FOR H0:<br>PARAMETER=0 | PROB>[T] |
|----------|----|-----------------------|-------------------|--------------------------|----------|
| INTERCEP | 1  | -1.69892785           | 0.37650582        | -4.512                   | 0.0001   |
| LOGFA    | 1  | -0.001769204          | 0.003271349       | -0.541                   | 0.5894   |
| LOGIA    | 1  | -0.01620329           | 0.002599416       | -6.233                   | 0.0001   |
| LOGRIV   | 1  | 0.003956906           | 0.003232395       | 1.224                    | 0.2227   |
| LOGSE    | 1  | 0.002651345           | 0.02105472        | 0.126                    | 0.9000   |
| LOGPI    | 1  | 0.71982181            | 0.03974944        | 18.109                   | 0.0001   |
| LOGPOP   | 1  | 1.18439844            | 0.01902552        | 62.253                   | 0.0001   |

| VARIABLE | DF | VARIABLE<br>LABEL                         |
|----------|----|---|
| INTERCEP | 1  | INTERCEPT                                 |
| LOGFA    | 1  | LOG FORMAL ALLIES MILITARY EXPENDITURES   |
| LOGIA    | 1  | LOG INFORMAL ALLIES MILITARY EXPENDITURES |
| LOGRIV   | 1  | LOG RIVALS MILITARY EXPENDITURES          |
| LOGSE    | 1  | LOG SOCIAL EXPENDITURES                   |
| LOGPI    | 1  | LOG PER CAPITA INCOME                     |
| LOGPOP   | 1  | LOG POPULATION                            |

TABLE 3

## WESTERN ANALYSIS OF VARIANCE

DEP VARIABLE: LOGME      LOG MILITARY EXPENDITURES

| SOURCE   | DF  | SUM OF<br>SQUARES | MEAN<br>SQUARE | F VALUE | PROB>F |
|----------|-----|-------------------|----------------|---------|--------|
| MODEL    | 6   | 710.24063         | 118.37344      | 672.134 | 0.0001 |
| ERROR    | 245 | 43.14840383       | 0.17611593     |         |        |
| C TOTAL  | 251 | 753.38904         |                |         |        |
|          |     |                   |                |         |        |
| ROOT MSE |     | 0.4196617         | R-SQUARE       | 0.9427  |        |
| DEP MEAN |     | 7.872221          | ADJ R-SQ       | 0.9413  |        |
| C.V.     |     | 5.330919          |                |         |        |

## PARAMETER ESTIMATES

| VARIABLE | DF | PARAMETER<br>ESTIMATE | STANDARD<br>ERROR | T FOR H0:<br>PARAMETER=0 | PROB>[T] |
|----------|----|-----------------------|-------------------|--------------------------|----------|
| INTERCEP | 1  | -1.02691921           | 0.43284052        | -2.373                   | 0.0184   |
| LOGFA    | 1  | -0.01558098           | 0.003012485       | -5.172                   | 0.0001   |
| LOGIA    | 1  | -0.01514734           | 0.002359414       | -6.420                   | 0.0001   |
| LOGRIV   | 1  | 0.002189391           | 0.002865129       | 0.764                    | 0.4455   |
| LOGSE    | 1  | 0.01347973            | 0.02112294        | 0.638                    | 0.5240   |
| LOGPI    | 1  | 0.61561329            | 0.04507859        | 13.656                   | 0.0001   |
| LOGPOP   | 1  | 1.15316012            | 0.02038248        | 56.576                   | 0.0001   |

| VARIABLE | DF | VARIABLE<br>LABEL                         |
|----------|----|---|
| INTERCEP | 1  | INTERCEPT                                 |
| LOGFA    | 1  | LOG FORMAL ALLIES MILITARY EXPENDITURES   |
| LOGIA    | 1  | LOG INFORMAL ALLIES MILITARY EXPENDITURES |
| LOGRIV   | 1  | LOG RIVALS MILITARY EXPENDITURES          |
| LOGSE    | 1  | LOG SOCIAL EXPENDITURES                   |
| LOGPI    | 1  | LOG PER CAPITA INCOME                     |
| LOGPOP   | 1  | LOG POPULATION                            |



The variables FA and IA are both negative and significant which fully supports the theory of Olson and Zeckhauser. Additionally, the variable FA is more negative than the variable IA and this was expected since the "free rider" effect is hypothesized to be stronger in a formal alliance.

### **3. WTO subsample**

Table 4 shows the results of the regression analysis of the Warsaw Treaty Organization. The adjusted  $r^2$  value of .9980 is extremely high and indicates that almost one hundred percent of the variation in the model is explained by the independent variables. Likewise, since "Prob>F" is less than the significance level of  $\alpha = .05$ , the regression as a whole is significant.

The variables FA and IA are both negative and significant which fully supports the theory of Olson and Zeckhauser. However, the variable IA is more negative than the variable FA and this tends to contradict their theory.

The variable RIV is negative and significant which suggests that an inverse relationship exists between a communist country's military expenditures and the military expenditures of its rivals.

### **4. LDC subsample**

Table 5 shows the results of the regression analysis of the Less Developed Countries subsample. The adjusted  $r^2$  value is the lowest of all the subsamples, yet it indicates that 79.6 percent of the variation in the model is explained by the independent variables. Likewise, since "Prob>F" is less than the significance level of  $\alpha = .05$ , the regression as a whole appears to be significant.

TABLE 4

## WTO ANALYSIS OF VARIANCE

DEP VARIABLE: LOGME

LOG MILITARY EXPENDITURES

| SOURCE   | DF | SUM OF<br>SQUARES | MEAN<br>SQUARE | F VALUE  | PROB>F |
|----------|----|-------------------|----------------|----------|--------|
| MODEL    | 6  | 137.68101         | 22.94683494    | 6187.873 | 0.0001 |
| ERROR    | 68 | 0.25216819        | 0.003708356    |          |        |
| C TOTAL  | 74 | 137.93318         |                |          |        |
| ROOT MSE |    | 0.06089627        | R-SQUARE       | 0.9982   |        |
| DEP MEAN |    | 9.233937          | ADJ R-SQ       | 0.9980   |        |
| C.V.     |    | 0.6594833         |                |          |        |

## PARAMETER ESTIMATES

| VARIABLE | DF | PARAMETER<br>ESTIMATE | STANDARD<br>ERROR | T FOR H0:<br>PARAMETER=0 | PROB>[T] |
|----------|----|-----------------------|-------------------|--------------------------|----------|
| INTERCEP | 1  | -3.04200226           | 0.70793302        | -4.297                   | 0.0001   |
| LOGFA    | 1  | -0.01525541           | 0.002073548       | -7.357                   | 0.0001   |
| LOGIA    | 1  | -0.04444542           | 0.002335416       | -19.031                  | 0.0001   |
| LOGRIV   | 1  | -0.02357944           | 0.002794211       | -8.439                   | 0.0001   |
| LOGSE    | 1  | 0.007071116           | 0.01229130        | 0.575                    | 0.5670   |
| LOGPI    | 1  | 0.68330476            | 0.08484870        | 8.053                    | 0.0001   |
| LOGPOP   | 1  | 1.74083769            | 0.02327208        | 74.804                   | 0.0001   |

| VARIABLE | DF | VARIABLE<br>LABEL                         |
|----------|----|---|
| INTERCEP | 1  | INTERCEPT                                 |
| LOGFA    | 1  | LOG FORMAL ALLIES MILITARY EXPENDITURES   |
| LOGIA    | 1  | LOG INFORMAL ALLIES MILITARY EXPENDITURES |
| LOGRIV   | 1  | LOG RIVALS MILITARY EXPENDITURES          |
| LOGSE    | 1  | LOG SOCIAL EXPENDITURES                   |
| LOGPI    | 1  | LOG PER CAPITA INCOME                     |
| LOGPOP   | 1  | LOG POPULATION                            |

Neither variable FA nor IA are negative. There is no evidence of an inverse relationship, therefore, the null hypothesis cannot be rejected.

There is no evidence of an inverse relationship between the variables SE and ME. However, the variable SE is significantly positive and possibly indicates that in general, for LDC nations, their defense spending increases with an increase in social spending.

Another observation is that the variable NONDEM is positive and significant. This may suggest that a totalitarian or authoritarian regime has a positive effect on the military expenditures of non-democratic LDC nations. It is easier for non-democratic regimes to spend more on defense. These results are consistent with the Gonzalez and Mehay research.

## **5. WTO & LDC subsample**

Table 6 shows the results of the regression analysis of the WTO/LDC subsample. The adjusted  $r^2$  value increases with the addition of WTO countries to the LDC subsample. At .8683, it indicates that a higher percentage of the variation in the model is explained by the independent variables. Likewise, since "Prob>F" is less than  $\alpha$ , the regression as a whole appears to be significant.

Neither variable FA nor IA are negative. There is no evidence of an inverse relationship, therefore, the null hypothesis cannot be rejected and the subsample does not support the theory of Olson and Zeckhauser. The variable IA is significantly positive and may suggest that there is a positive relationship between a country's defense spending and the defense spending of its allies which is consistent with the Sandler argument.

TABLE 5

## LDC ANALYSIS OF VARIANCE

DEP VARIABLE: LOGME LOG MILITARY EXPENDITURES

| SOURCE   | DF  | SUM OF<br>SQUARES | MEAN<br>SQUARE | F VALUE | PROB>F |
|----------|-----|-------------------|----------------|---------|--------|
| MODEL    | 7   | 1281.41969        | 183.05996      | 271.396 | 0.0001 |
| ERROR    | 478 | 322.41748         | 0.67451356     |         |        |
| C TOTAL  | 485 | 1603.83717        |                |         |        |
|          |     |                   |                |         |        |
| ROOT MSE |     | 0.8212877         | R-SQUARE       | 0.7990  |        |
| DEP MEAN |     | 5.673016          | ADJ R-SQ       | 0.7960  |        |
| C.V.     |     | 14.47709          |                |         |        |

## PARAMETER ESTIMATES

| VARIABLE | DF | PARAMETER<br>ESTIMATE | STANDARD<br>ERROR | T FOR H0:<br>PARAMETER=0 | PROB>[T] |
|----------|----|-----------------------|-------------------|--------------------------|----------|
| INTERCEP | 1  | -5.01962139           | 0.36038240        | -13.929                  | 0.0001   |
| LOGFA    | 1  | 0.002845855           | 0.004144597       | 0.687                    | 0.4926   |
| LOGIA    | 1  | 0.005661896           | 0.003459463       | 1.637                    | 0.1024   |
| LOGRIV   | 1  | -0.000733747          | 0.003907063       | -0.188                   | 0.8511   |
| LOGSE    | 1  | 0.06693371            | 0.02597946        | 2.576                    | 0.0103   |
| LOGPI    | 1  | 1.13985850            | 0.03861522        | 29.518                   | 0.0001   |
| LOGPOP   | 1  | 0.98781017            | 0.02927152        | 33.746                   | 0.0001   |
| NONDEM   | 1  | 0.25512187            | 0.13398197        | 1.904                    | 0.0575   |

| VARIABLE | DF | VARIABLE<br>LABEL                         |
|----------|----|---|
| INTERCEP | 1  | INTERCEPT                                 |
| LOGFA    | 1  | LOG FORMAL ALLIES MILITARY EXPENDITURES   |
| LOGIA    | 1  | LOG INFORMAL ALLIES MILITARY EXPENDITURES |
| LOGRIV   | 1  | LOG RIVALS MILITARY EXPENDITURES          |
| LOGSE    | 1  | LOG SOCIAL EXPENDITURES                   |
| LOGPI    | 1  | LOG PER CAPITA INCOME                     |
| LOGPOP   | 1  | LOG POPULATION                            |
| NONDEM   | 1  | NON-DEMOCRATIC                            |



TABLE 6

## WTO AND LDC ANALYSIS OF VARIANCE

DEP VARIABLE: LOGME LOG MILITARY EXPENDITURES

| SOURCE   | DF  | SUM OF<br>SQUARES | MEAN<br>SQUARE | F VALUE | PROB>F |
|----------|-----|-------------------|----------------|---------|--------|
| MODEL    | 7   | 2231.87132        | 318.83876      | 528.261 | 0.0001 |
| ERROR    | 553 | 333.77039         | 0.60356309     |         |        |
| C TOTAL  | 560 | 2565.64171        |                |         |        |
|          |     |                   |                |         |        |
| ROOT MSE |     | 0.7768932         | R-SQUARE       | 0.8699  |        |
| DEP MEAN |     | 6.149075          | ADJ R-SQ       | 0.8683  |        |
| C.V.     |     | 12.63431          |                |         |        |

## PARAMETER ESTIMATES

| VARIABLE | DF | PARAMETER<br>ESTIMATE | STANDARD<br>ERROR | T FOR H0:<br>PARAMETER=0 | PROB>[T] |
|----------|----|-----------------------|-------------------|--------------------------|----------|
| INTERCEP | 1  | -5.09160431           | 0.32557321        | -15.639                  | 0.0001   |
| LOGFA    | 1  | 0.002702479           | 0.003470462       | 0.779                    | 0.4365   |
| LOGIA    | 1  | 0.007149836           | 0.002778105       | 2.574                    | 0.0103   |
| LOGRIV   | 1  | -0.000030275          | 0.003197592       | -0.009                   | 0.9924   |
| LOGSE    | 1  | 0.04736550            | 0.02106279        | 2.249                    | 0.0249   |
| LOGPI    | 1  | 1.16478339            | 0.03520271        | 33.088                   | 0.0001   |
| LOGPOP   | 1  | 1.02294579            | 0.02436056        | 41.992                   | 0.0001   |
| NONDEM   | 1  | 0.42099477            | 0.10231441        | 4.115                    | 0.0001   |

| VARIABLE | DF | VARIABLE<br>LABEL                         |
|----------|----|---|
| INTERCEP | 1  | INTERCEPT                                 |
| LOGFA    | 1  | LOG FORMAL ALLIES MILITARY EXPENDITURES   |
| LOGIA    | 1  | LOG INFORMAL ALLIES MILITARY EXPENDITURES |
| LOGRIV   | 1  | LOG RIVALS MILITARY EXPENDITURES          |
| LOGSE    | 1  | LOG SOCIAL EXPENDITURES                   |
| LOGPI    | 1  | LOG PER CAPITA INCOME                     |
| LOGPOP   | 1  | LOG POPULATION                            |
| NONDEM   | 1  | NON-DEMOCRATIC                            |

In the combined subsample, there is no evidence of an inverse relationship between the variable SE and the variable ME. However, the variable SE remains significantly positive and may indicate that defense spending increases with an increase in social spending.

The dummy variable NONDEM also remains positive and significant leading to the conclusion that a totalitarian or authoritarian regime may have a positive effect on the military expenditures of non-democratic LDC/WTO nations.

Although not central to this study, the results of this subsample also show that a nation's military expenditures increase as its income and population increases.

## **6. WESTERN & LDC subsample**

Table 7 shows the results of the regression analysis of the combined Western/LDC countries. The adjusted  $r^2$  value increases with the addition of Western countries to the LDC subsample. Now, 87.77 percent of the variation in the model can be explained by the independent variables. As well, since "Prob>F" is less than  $\alpha$ , the regression as a whole is significant.

The addition of Western countries to the LDC sample causes no change to the coefficients of the variables FA or IA. Therefore, the null hypothesis cannot be rejected.

The SE variable remains positive and significant which may indicate that the military expenditures of these nations increase as the social expenditures increase. Similarly, the dummy variable NONDEM remains positive and significant.

TABLE 7

## WESTERN AND LDC ANALYSIS OF VARIANCE

DEP VARIABLE: LOGME LOG MILITARY EXPENDITURES

| SOURCE   | DF  | SUM OF<br>SQUARES | MEAN<br>SQUARE | F VALUE | PROB>F |
|----------|-----|-------------------|----------------|---------|--------|
| MODEL    | 8   | 2777.64719        | 347.20590      | 662.249 | 0.0001 |
| ERROR    | 729 | 382.20250         | 0.52428326     |         |        |
| C TOTAL  | 737 | 3159.84969        |                |         |        |
| ROOT MSE |     | 0.7240741         | R-SQUARE       | 0.8790  |        |
| DEP MEAN |     | 6.423964          | ADJ R-SQ       | 0.8777  |        |
| C.V.     |     | 11.27145          |                |         |        |

## PARAMETER ESTIMATES

| VARIABLE | DF | PARAMETER<br>ESTIMATE | STANDARD<br>ERROR | T FOR H0:<br>PARAMETER=0 | PROB>[T] |
|----------|----|-----------------------|-------------------|--------------------------|----------|
| INTERCEP | 1  | -4.51679781           | 0.22152643        | -20.389                  | 0.0001   |
| LOGFA    | 1  | 0.003769554           | 0.003020645       | 1.248                    | 0.2125   |
| LOGIA    | 1  | 0.000851205           | 0.002378724       | 0.358                    | 0.7206   |
| LOGRIV   | 1  | -0.001269960          | 0.002786616       | -0.456                   | 0.6487   |
| LOGSE    | 1  | 0.04448357            | 0.01877921        | 2.369                    | 0.0181   |
| LOGPI    | 1  | 1.06494446            | 0.02090740        | 50.936                   | 0.0001   |
| LOGPOP   | 1  | 1.03402256            | 0.02018309        | 51.232                   | 0.0001   |
| NONDEM   | 1  | 0.45702306            | 0.10576054        | 4.321                    | 0.0001   |
| CONSTR   | 1  | -1.13308411           | 0.14408636        | -7.864                   | 0.0001   |

| VARIABLE | DF | VARIABLE<br>LABEL                         |
|----------|----|---|
| INTERCEP | 1  | INTERCEPT                                 |
| LOGFA    | 1  | LOG FORMAL ALLIES MILITARY EXPENDITURES   |
| LOGIA    | 1  | LOG INFORMAL ALLIES MILITARY EXPENDITURES |
| LOGRIV   | 1  | LOG RIVALS MILITARY EXPENDITURES          |
| LOGSE    | 1  | LOG SOCIAL EXPENDITURES                   |
| LOGPI    | 1  | LOG PER CAPITA INCOME                     |
| LOGPOP   | 1  | LOG POPULATION                            |
| NONDEM   | 1  | NON-DEMOCRATIC                            |
| CONSTR   | 1  | CONSTRAINED                               |

The dummy variable CONSTR is negative and significant. This indicates that for those countries constrained by treaty or constitution, their military expenditures are limited. This is consistent with the prior research of Gonzalez and Mehay.

## **7. FULL sample**

Table 8 shows the results of the regression analysis for the Full sample of seventy-five countries. The adjusted  $r^2$  value is high and "Prob>F" is less than  $\alpha$  indicating that the regression as a whole is significant.

Both FA and IA variables are positive. As a result, the null hypothesis cannot be rejected and the theory of Olson and Zeckhauser is not supported.

The variable SE is significantly positive and may indicate that as a nation's social spending increases, its military expenditures also rise.

As expected, the dummy variable NONDEM is positive and significant and the dummy variable CONSTR is negative and significant. Both are consistent with the Gonzalez and Mehay research.

## **D. MULTICOLLINEARITY**

In multiple regression analysis, the regression coefficients often become less reliable as the degree of correlation between the independent variables increases. If there is a high level of correlation between them, a problem called "multicollinearity" exists [Ref. 9:p. 672].

Multicollinearity is essentially a sample phenomena in the sense that even if the independent variables are not linearly related in the population, they may be related in the particular sample of study. It may happen that in any given sample some or all



TABLE 8

## FULL SAMPLE ANALYSIS OF VARIANCE

DEP VARIABLE: LOGME LOG MILITARY EXPENDITURES

| SOURCE   | DF  | SUM OF<br>SQUARES | MEAN<br>SQUARE | F VALUE | PROB>F |
|----------|-----|-------------------|----------------|---------|--------|
| MODEL    | 8   | 3442.50095        | 430.31262      | 880.676 | 0.0001 |
| ERROR    | 804 | 392.84748         | 0.48861627     |         |        |
| C TOTAL  | 812 | 3835.34843        |                |         |        |
| ROOT MSE |     | 0.6990109         | R-SQUARE       | 0.8976  |        |
| DEP MEAN |     | 6.683186          | ADJ R-SQ       | 0.8966  |        |
| C.V.     |     | 10.45925          |                |         |        |

## PARAMETER ESTIMATES

| VARIABLE | DF | PARAMETER<br>ESTIMATE | STANDARD<br>ERROR | T FOR H0:<br>PARAMETER=0 | PROB>[T] |
|----------|----|-----------------------|-------------------|--------------------------|----------|
| INTERCEP | 1  | -4.53199003           | 0.20549388        | -22.054                  | 0.0001   |
| LOGFA    | 1  | 0.003501692           | 0.002687869       | 1.303                    | 0.1930   |
| LOGIA    | 1  | 0.001863448           | 0.002062609       | 0.903                    | 0.3666   |
| LOGRIV   | 1  | -0.001317279          | 0.002426025       | -0.543                   | 0.5873   |
| LOGSE    | 1  | 0.03369359            | 0.01615709        | 2.085                    | 0.0374   |
| LOGPI    | 1  | 1.07283749            | 0.01986904        | 53.995                   | 0.0001   |
| LOGPOP   | 1  | 1.05650440            | 0.01792181        | 58.951                   | 0.0001   |
| NONDEM   | 1  | 0.63610342            | 0.07134800        | 8.916                    | 0.0001   |
| CONSTR   | 1  | -1.11859859           | 0.13833895        | -8.086                   | 0.0001   |

| VARIABLE | DF | VARIABLE<br>LABEL                         |
|----------|----|---|
| INTERCEP | 1  | INTERCEPT                                 |
| LOGFA    | 1  | LOG FORMAL ALLIES MILITARY EXPENDITURES   |
| LOGIA    | 1  | LOG INFORMAL ALLIES MILITARY EXPENDITURES |
| LOGRIV   | 1  | LOG RIVALS MILITARY EXPENDITURES          |
| LOGSE    | 1  | LOG SOCIAL EXPENDITURES                   |
| LOGPI    | 1  | LOG PER CAPITA INCOME                     |
| LOGPOP   | 1  | LOG POPULATION                            |
| NONDEM   | 1  | NON-DEMOCRATIC                            |
| CONSTR   | 1  | CONSTRAINED                               |

of the independent variables are so highly collinear that one cannot isolate their individual influence on the dependent variable.

Multicollinearity is a matter of degree and not of type. The meaningful distinction is not between its presence or absence, but between its various degrees. Therefore, the researcher measures the degree of multicollinearity in a particular sample.

Table 9 shows the results of the collinearity diagnostics test for the full sample of seventy-five countries. The eigenvalue and condition number give an overall indication of the degree of multicollinearity present. The "bottom line" condition number shows the cumulative effect of multicollinearity. As a general rule of thumb, a "bottom line" condition number greater than 30 means that multicollinearity could be a problem in the sample. When this number is large, the problem is said to be "ill-conditioned"; when this number is extremely large, the estimates may have a fair amount of numerical error [Ref. 9:p. 672].

As shown in Table 9, the test yields a condition number of only 21.7 which indicates that the sample has a relatively low degree of multicollinearity. This was expected because the multiple regression had very few of the indicators of multicollinearity, namely high standard errors, relatively small computed t-values, and relatively large Prob>[T] values.

## **E. SUMMARY**

Table 10 summarizes the various regression results. Of the six subsamples, WTO and Western fully support the theory of Olson and Zeckhauser. In these subsamples, the coefficient of the variable FA was more negative than the coefficient

TABLE 9

## COLLINEARITY DIAGNOSTICS

| <u>NUMBER</u> | <u>EIGENVALUE</u> | <u>CONDITION<br/>NUMBER</u> | <u>VAR<br/>PROP<br/>INTERCEP</u> | <u>VAR<br/>PROP<br/>LOGFA</u> | <u>VAR<br/>PROP<br/>LOGIA</u> | <u>VAR<br/>PROP<br/>LOGRIV</u> | <u>VAR<br/>PROP<br/>LOGSE</u> |
|---------------|-------------------|-----------------------------|----------------------------------|-------------------------------|-------------------------------|--------------------------------|-------------------------------|
| 1             | 4.561723          | 1.000000                    | 0.0007                           | 0.0035                        | 0.0098                        | 0.0001                         | 0.0013                        |
| 2             | 1.554812          | 1.712875                    | 0.0000                           | 0.0661                        | 0.0000                        | 0.1493                         | 0.0002                        |
| 3             | 0.945646          | 2.196344                    | 0.0000                           | 0.0000                        | 0.0503                        | 0.0815                         | 0.0000                        |
| 4             | 0.772934          | 2.429368                    | 0.0000                           | 0.0756                        | 0.4270                        | 0.0070                         | 0.0000                        |
| 5             | 0.708613          | 2.537231                    | 0.0003                           | 0.0009                        | 0.0046                        | 0.0827                         | 0.0009                        |
| 6             | 0.236938          | 4.387799                    | 0.0042                           | 0.4159                        | 0.3976                        | 0.4336                         | 0.0152                        |
| 7             | 0.185740          | 4.955777                    | 0.0021                           | 0.1144                        | 0.0455                        | 0.1861                         | 0.0022                        |
| 8             | 0.023909          | 13.812743                   | 0.0017                           | 0.3172                        | 0.0648                        | 0.0000                         | 0.5821                        |
| 9             | 0.0096857         | 21.702010                   | 0.9911                           | 0.0064                        | 0.0004                        | 0.0597                         | 0.3980                        |

| <u>NUMBER</u> | <u>VAR PROP<br/>LOGPI</u> | <u>VAR PROP<br/>LOGPOP</u> | <u>VAR PROP<br/>NONDEM</u> | <u>VAR PROP<br/>CONSTR</u> |
|---------------|---------------------------|----------------------------|----------------------------|----------------------------|
| 1             | 0.0012                    | 0.0083                     | 0.0083                     | 0.0021                     |
| 2             | 0.0000                    | 0.0003                     | 0.0000                     | 0.0965                     |
| 3             | 0.0000                    | 0.0001                     | 0.3250                     | 0.2800                     |
| 4             | 0.0001                    | 0.0024                     | 0.0060                     | 0.1531                     |
| 5             | 0.0000                    | 0.0129                     | 0.5412                     | 0.3020                     |
| 6             | 0.0041                    | 0.0379                     | 0.0028                     | 0.0654                     |
| 7             | 0.0122                    | 0.8126                     | 0.0122                     | 0.0002                     |
| 8             | 0.4952                    | 0.0892                     | 0.0913                     | 0.0386                     |
| 9             | 0.4871                    | 0.0362                     | 0.0133                     | 0.0621                     |

of the variable IA. The NATO subsample partially supports their theory because both coefficients were negative. The results indicate the "free riding" pattern of some nations on the defense output of others. However, the "free rider" theory cannot be completely supported because all the subsamples and the full sample should have yielded similar results.

The theory of Olson and Zeckhauser postulates that there is an inverse relationship between the military expenditures of nations and their allies. According to the theory, this inverse relationship applies to formal and informal allies. However, as table 10 shows, there is inconclusive evidence for this hypothesis, particularly during the period 1974-1984.

The "joint product" model of Sandler may be supported in those cases where the coefficient of both variables, FA and IA, are positive. There are four samples/subsamples where this occurs: Full sample, LDC, WTO/LDC, and Western/LDC. However, only one of the coefficients (IA for WTO/LDC) is significant at an  $\alpha = .05$ . Therefore, the Sandler argument cannot be fully supported either.

Although not central to this study, the results show that there is no evidence of an inverse relationship between a nation's income and its military expenditures. Likewise, the results reveal no evidence of an inverse relationship between a nation's population and its military expenditures. In all the samples the coefficients of the Population and Income variables were positively significant and may suggest that as a nation's income and population increase, its military expenditures also increase.

The coefficient of the variable Social Expenditures was significantly positive in four samples: Full sample, LDC, WTO/LDC, and Western/LDC. These results may



TABLE 10

## REGRESSION SUMMARY OF COEFFICIENT ESTIMATES

| <u>Variable</u>    | <u>Full Sample</u>   | <u>NATO</u>          | <u>WTO</u>           | <u>LDC</u>          |
|--------------------|----------------------|----------------------|----------------------|---------------------|
| FA                 | 0.0035<br>(0.003)    | -0.0018<br>(0.003)   | -0.0153ss<br>(0.002) | 0.0028<br>(0.004)   |
| IA                 | 0.0019<br>(0.002)    | -0.0162ss<br>(0.002) | -0.0444ss<br>(0.002) | 0.0057s<br>(0.003)  |
| RIV                | -0.0013<br>(0.002)   | 0.0039<br>(0.003)    | -0.0236ss<br>(0.003) | -0.0007<br>(0.004)  |
| SE                 | 0.0337ss<br>(0.016)  | 0.0027<br>(0.021)    | 0.0071<br>(0.012)    | 0.0669ss<br>(0.026) |
| PI                 | 1.0728ss<br>(0.019)  | 0.7198ss<br>(0.039)  | 0.6833ss<br>(0.084)  | 1.1399ss<br>(0.038) |
| POP                | 1.0565ss<br>(0.018)  | 1.1844ss<br>(0.019)  | 1.7408ss<br>(0.023)  | 0.9878ss<br>(0.029) |
| NONDEM             | 0.6361ss<br>(0.071)  | NA                   | NA                   | 0.2551ss<br>(0.133) |
| CONSTR             | -1.1186ss<br>(0.138) | NA                   | NA                   | NA                  |
| ADJ R <sup>2</sup> | .8966                | .9692                | .9980                | .7960               |

s = significant at .10

ss = significant at .05

(standard errors in parentheses)

TABLE 10 cont.

| <u>Variable</u>    | <u>Western</u>       | <u>WTO + LDC</u>    | <u>Western + LDC</u> |
|--------------------|----------------------|---------------------|----------------------|
| FA                 | -0.0156ss<br>(0.003) | 0.0027<br>(0.003)   | 0.0038<br>(0.003)    |
| IA                 | -0.0151ss<br>(0.002) | 0.0071ss<br>(0.003) | 0.0008<br>(0.002)    |
| RIV                | 0.0021<br>(0.003)    | -0.00003<br>(0.003) | -0.0012<br>(0.003)   |
| SE                 | 0.0135<br>(0.021)    | 0.0474ss<br>(0.021) | 0.0444ss<br>(0.018)  |
| PI                 | 0.6156ss<br>(0.045)  | 1.1647ss<br>(0.035) | 1.0649ss<br>(0.021)  |
| POP                | 1.1532ss<br>(0.020)  | 1.0229ss<br>(0.024) | 1.0340ss<br>(0.020)  |
| NONDEM             | NA                   | 0.4209ss<br>(0.102) | 0.4570ss<br>(0.106)  |
| CONSTR             | NA                   | NA                  | -1.1331ss<br>(0.144) |
| ADJ R <sup>2</sup> | .9413                | .8683               | .8777                |

---

s = significant at .10

ss = significant at .05

(standard errors in parentheses)

suggest that the less developed countries increase their social expenditures with an increase in military expenditures. This of course contradicts the trade-off argument between social and defense spending.

The coefficient of the Rival variable was negative in all the regressions except NATO and Western. Of particular note, it was significant in the WTO subsample. This would indicate that as the defense spending of a rival (NATO) increased, the communist countries spent less on defense or vice versa.

In all the samples where the NONDEM and CONSTR variables were applicable, their coefficients were significant. The NONDEM variable was consistently positive and the CONSTR variable was consistently negative. The significance of these two dummy variables must not be overlooked. They provide an indication that the type of political regime and whether a nation uses conscription or volunteer armed service affects its military expenditures.

Computer regressions were run on the full sample and six subsamples for different time periods between 1974 and 1984. The purpose of these regressions was to determine if other factors relating to time period, such as the "flexible response doctrine" of the early 1970's or the Reagan defense build-up initiatives of the early 1980's, played a major role in the relationship of military expenditures of nations. The regression results were essentially the same as those for the entire eleven year time period. Therefore, one can conclude that specific year or time period was not a significant factor affecting a country's defense spending in relation to the defense expenditures of its allies and rivals.

## VI. CONCLUSION

### A. FINDINGS

The Stockholm International Peace Research Institute describes the meaning of military expenditure in the following way:

Military expenditure figures, presented in different ways, have a variety of uses, including the measurement of the economic burden of these expenditures and the assessment of the trend in a nation's military strength. Moreover, the international comparison of military expenditures influences opinions about how much should be spent in the future. And, in military alliances, the relative economic burden of these expenditures between member nations is a frequently discussed, and often contentious, issue...As a general rule aggregate military expenditure is considered to be made up of the following components: 1) pay and allowances of military personnel, 2) pay of civilian personnel, 3) operations and maintenance (O&M), 4) procurement, 5) research and development (R&D), and 6) construction. In addition, in many or most cases the following activities are also regarded as military expenditure: 7) pensions to retired military personnel, 8) military aid, 9) civil defense, 10) para-military forces, and 11) military aspects of activities that are acknowledged as having a joint civil/military function, for example, space or atomic energy. By and large it is the expenditure aggregate made up of items 1 to 11 that is evaluated internally and compared internationally. The main point to be borne in mind is that the economic impact of the military is more pervasive than an analysis of explicit military expenditure would suggest. [Ref. 10:p. 5]

Distinct from this vein of thought, this research has attempted to reveal "significant" factors that were likely to have an influence on the outcome of a nation's military spending. It is inherently implied that when a nation makes expenditures for its security it will have less to spend in other areas of budgeted government spending. The idea of opportunity cost underlies this premise.

According to The Stockholm Research Institute, opportunity cost is a concept in economics that "stems from the fundamental postulate that resources are scarce." A



corollary of scarcity is that the employment of resources in one activity has a "cost" in terms of the output these resources might have produced in some other activity. [Ref. 10:p. 9]

The Research Institute further states that confining the analysis to specified military expenditure omits some potentially important aspects of the opportunity cost of the military. Specifically, to the extent that governments (a) allocate expenditures other than those explicitly labeled as military or (b) intervene in the private sector or (c) disrupt the pattern of international trade with military considerations in mind, there will be an additional cost in the sense that, from an economic and social viewpoint, resources will be misallocated both nationally and internationally. The Institute's approach to estimating opportunity cost is to take each major category of military expenditure and ask the following question: "Assuming a transfer of these military resources to civilian uses, is there any reason to suppose that the value of civilian output would be substantially different from the actual sum of (military) expenditure in these areas." [Ref. 10:p. 9]

There has been much research in the area of military expenditure patterns of alliances. According to Olson and Zeckhauser [Ref. 3:p. 268]:

When a nation decides how large a military force to provide in an alliance, it must consider the value it places upon collective defense and the other, nondefense, goods that must be sacrificed to obtain additional military forces...In an alliance, the amount a nation spends on defense will be affected by the amount its allies provide.

The theme presented here is the traditional view and seems to hold true throughout most of the literature written on military alliances.

This study assumed that if members of an alliance increase or decrease their spending for security, it will affect their allies defense spending. Because defense is considered to be a "public good," an increase in the defense output by one member encourages another member to reduce its military output. The relationship among alliance members, however, is not proportional.

In contrast to the traditional view, Todd Sandler and his colleagues suggest that when the jointly produced outputs are complementary, allies could increase their defense expenditures in response to spill-ins. Commenting on the Olson and Zeckhauser model, Sandler [Ref. 8:p. 240] offers the following:

They depicted NATO as sharing a pure public good in the form of deterrence, which relies on the credible threat of retaliation to forestall hostilities between opposing alliances. The punishment threat associated with deterrence is nonrival in consumption since additional allies can share this threat without diminishing the deterrence provided to existing allies...In particular, their model predicted that disproportionate burdens would be shouldered by the large, rich allies as the poorer allies rode free on the richer countries' defense contributions.

This study also assumed that because of the "public good" nature of defense smaller and less wealthy nations would take advantage of the alliance contributions of their larger and wealthier counter-parts.

This research focused on eight variables thought to have a significant influence on government decisions in the area of defense spending. These variables included: the size of a country's population (POP), income per capita (PI), government social expenditures (SE), military expenditures of formal allies (FA), military expenditures of informal allies (IA), military expenditures of rival countries (RIV), non-democratic nations (NONDEM), and countries constrained by treaty or constitution (CONSTR). The CONSTR variable applied only to Japan, Austria, and Finland.

In the case of the variable population, intuitively it should be assumed that the larger a nation, the more capital resources it may have and will probably spend on defense. This of course, assumes that the country considers the commodity of security as a "normal good." In other words, the more dollars a nation has available to spend, the more it will allot to obtain a greater quantity of this good. In their research, Gonzalez and Mehay conclude that there will be a proportional or more than proportional (depending on the presence of economies of size) increase between defense spending and corresponding changes in the size of a nation's population [Ref. 4:p. 19]. According to these two economists, there have been major deficiencies and inadequacies with prior models.

Although the coefficient of the variable population was positive and significant in all samples as expected, the results do not necessarily conclude that larger countries may be more or less efficient than smaller ones in their expenditures. The significant point is that the evidence may suggest that a positive relationship exists between military expenditures and the population of a country.

The coefficient of the variable per capita income was positive and significant in all samples. These results are consistent with prior research on military expenditures.

The coefficient of the variable social expenditures was positive in all samples and significant in the following four: Full sample, LDC, WTO/LDC, and Western/LDC. It was expected that the trade-off between defense and social spending would impart a negative sign to this variable. However, these results may indicate that there is a positive relationship between the social and military expenditures of many nations, particularly the less developed countries.

A possible explanation for this positive relationship would be the ability of the government to tax its people or control the majority of the nation's resources as in the case of a communist regime. This line of reasoning is supported by the results because the coefficient of the variable social expenditures was positive in all samples.

The coefficient of the Rival variable was negative and significant in the WTO subsample. This seems to indicate that as the defense spending of a rival increased, the WARSAW pact countries spent less on defense. Perhaps the contrary is true, as the communist countries spent more on defense, their rivals spent less. This last line of reasoning is plausible because if the trend in a rival country (i.e., US) over time is in the opposite direction of a WTO nation, this would impart a negative sign to the RIV variable. Such would be the case when NATO decreased its military expenditures during the aftermath of the Vietnam War in the 1970's and the Soviet Union increased its military spending.

The coefficients of the NONDEM and CONSTR dummy variables were significant in all applicable samples. The NONDEM variable was consistently positive and the CONSTR variable was consistently negative. These results were expected and are consistent with the Gonzalez and Mehay study.

The coefficients of the variables FA (military expenditures of formal allies) and IA (military expenditures of informal allies) were negative in three samples: NATO, WTO, and Western. This states clearly that the results from some of the samples lend support to the Olson and Zeckhauser view of an inverse relationship between the military expenditures of allies, but the results from other samples do not.



The results of this study are uniquely tied to country classifications. The effects of FA, IA, and RIV are based on the definition of what constitutes a formal ally, an informal ally or a rival. Different classifications could have yielded dissimilar results.

According to the theory, the inverse relationship applies to formal and informal allies alike. However, there is inconclusive evidence for this hypothesis, particularly during the period 1974-1984. It is possible that for a particular period in history (i.e., 1960's) alliance members behaved as the theory suggests; but today, twenty-three years after the Olson and Zeckhauser research, the world environment has changed.

## **B. RECOMMENDATIONS**

This study is a first attempt into an uncharted area for thesis research. It should be repeated using different conceptualizations of country classifications to determine if the relationships found in this study are stable. Further research in this area is needed, but particular attention should be focused on the classification of the less-developed countries (LDC) to alleviate the possibility that the results may be incomplete and misleading. Additionally, only variables that have the fullest scope of sample data should be used in the model. The variable CONSTR did not encompass enough of a sampling to prove conclusively its influence and value in the model since it was composed of only three countries. Nevertheless, the results exposed some of the weaknesses in the Olson and Zeckhauser view of military alliances.

## APPENDIX

### COUNTRY DATA

| YR         | ME   | GE    | POP  | PI   | BK   |
|------------|------|-------|------|------|------|
| <hr/>      |      |       |      |      |      |
| Australia: |      |       |      |      |      |
| 1974       | 2599 | 24820 | 13.6 | 8880 | WEST |
| 1975       | 2672 | 30990 | 13.8 | 8897 | WEST |
| 1976       | 2731 | 34310 | 13.9 | 9002 | WEST |
| 1977       | 3040 | 35780 | 14.1 | 9142 | WEST |
| 1978       | 2981 | 35520 | 14.2 | 9098 | WEST |
| 1979       | 3052 | 35710 | 14.4 | 9392 | WEST |
| 1980       | 3593 | 39570 | 14.6 | 9716 | WEST |
| 1981       | 3818 | 40950 | 14.8 | 9859 | WEST |
| 1982       | 4028 | 42170 | 15.1 | 9897 | WEST |
| 1983       | 4308 | 45120 | 15.3 | 9651 | WEST |
| 1984       | 4502 | 48420 | 15.5 | 9990 | WEST |
| Austria:   |      |       |      |      |      |
| 1974       | 535  | 17470 | 7.6  | 7108 | WEST |
| 1975       | 597  | 18820 | 7.6  | 6990 | WEST |
| 1976       | 626  | 20250 | 7.6  | 7388 | WEST |
| 1977       | 648  | 20970 | 7.6  | 7689 | WEST |
| 1978       | 694  | 22880 | 7.6  | 7764 | WEST |
| 1979       | 734  | 23840 | 7.6  | 8172 | WEST |
| 1980       | 731  | 24630 | 7.6  | 8432 | WEST |
| 1981       | 726  | 25400 | 7.6  | 8420 | WEST |
| 1982       | 808  | 25910 | 7.6  | 8510 | WEST |
| 1983       | 890  | 27350 | 7.6  | 8830 | WEST |
| 1984       | 891  | 27160 | 7.6  | 8892 | WEST |
| Belgium:   |      |       |      |      |      |
| 1974       | 2003 | 28730 | 9.8  | 7467 | NATO |
| 1975       | 2175 | 31810 | 9.8  | 7285 | NATO |
| 1976       | 2326 | 34480 | 9.8  | 7685 | NATO |
| 1977       | 2391 | 36130 | 9.8  | 7759 | NATO |
| 1978       | 2560 | 38760 | 9.8  | 7999 | NATO |
| 1979       | 2622 | 40530 | 9.8  | 8142 | NATO |
| 1980       | 2712 | 42010 | 9.8  | 8286 | NATO |
| 1981       | 2801 | 45590 | 9.9  | 8155 | NATO |
| 1982       | 2750 | 46120 | 9.9  | 8242 | NATO |
| 1983       | 2672 | 46470 | 9.9  | 8242 | NATO |
| 1984       | 2580 | 46610 | 9.9  | 8372 | NATO |

| YR       | ME   | GE    | POP  | PI    | BK   |
|----------|------|-------|------|-------|------|
| <hr/>    |      |       |      |       |      |
| Canada:  |      |       |      |       |      |
| 1974     | 5108 | 59950 | 22.4 | 11680 | NATO |
| 1975     | 5039 | 65410 | 22.7 | 11630 | NATO |
| 1976     | 5288 | 64860 | 23.0 | 12130 | NATO |
| 1977     | 5667 | 65470 | 23.3 | 12220 | NATO |
| 1978     | 6018 | 69180 | 23.6 | 12530 | NATO |
| 1979     | 5630 | 68590 | 23.8 | 12770 | NATO |
| 1980     | 5727 | 71050 | 24.1 | 12800 | NATO |
| 1981     | 5922 | 76000 | 24.4 | 13060 | NATO |
| 1982     | 6532 | 80250 | 24.7 | 12320 | NATO |
| 1983     | 6563 | 83190 | 24.9 | 12600 | NATO |
| 1984     | 7350 | 89840 | 25.2 | 13100 | NATO |
| Denmark: |      |       |      |       |      |
| 1974     | 1112 | 17080 | 5.0  | 9498  | NATO |
| 1975     | 1183 | 17390 | 5.1  | 9367  | NATO |
| 1976     | 1162 | 17220 | 5.1  | 9984  | NATO |
| 1977     | 1192 | 17680 | 5.1  | 10110 | NATO |
| 1978     | 1235 | 18370 | 5.1  | 10180 | NATO |
| 1979     | 1264 | 19690 | 5.1  | 10420 | NATO |
| 1980     | 1320 | 21560 | 5.1  | 10300 | NATO |
| 1981     | 1355 | 22760 | 5.1  | 10150 | NATO |
| 1982     | 1379 | 24120 | 5.1  | 10370 | NATO |
| 1983     | 1375 | 24900 | 5.1  | 10620 | NATO |
| 1984     | 1349 | 25440 | 5.1  | 10990 | NATO |
| Finland: |      |       |      |       |      |
| 1974     | 479  | 10100 | 4.7  | 8172  | WEST |
| 1975     | 570  | 12030 | 4.7  | 8158  | WEST |
| 1976     | 511  | 12450 | 4.1  | 8144  | WEST |
| 1977     | 536  | 12840 | 4.2  | 8123  | WEST |
| 1978     | 558  | 12550 | 4.4  | 8290  | WEST |
| 1979     | 622  | 13320 | 4.7  | 8915  | WEST |
| 1980     | 719  | 13530 | 5.3  | 9392  | WEST |
| 1981     | 676  | 13720 | 4.9  | 9486  | WEST |
| 1982     | 740  | 14660 | 5.0  | 9695  | WEST |
| 1983     | 843  | 15530 | 5.4  | 9935  | WEST |
| 1984     | 764  | 15180 | 5.0  | 10150 | WEST |

| YR            | ME    | GE     | POP  | PI    | BK   |
|---------------|-------|--------|------|-------|------|
| <hr/>         |       |        |      |       |      |
| France:       |       |        |      |       |      |
| 1974          | 15950 | 151100 | 52.5 | 8145  | NATO |
| 1975          | 16420 | 163200 | 52.8 | 8111  | NATO |
| 1976          | 17090 | 171800 | 53.0 | 8508  | NATO |
| 1977          | 18110 | 176700 | 53.2 | 8736  | NATO |
| 1978          | 19090 | 187200 | 53.4 | 9027  | NATO |
| 1979          | 19620 | 197300 | 53.6 | 9303  | NATO |
| 1980          | 20210 | 201400 | 53.9 | 9364  | NATO |
| 1981          | 20990 | 217700 | 54.1 | 9353  | NATO |
| 1982          | 21280 | 235300 | 54.4 | 9452  | NATO |
| 1983          | 21650 | 235600 | 54.6 | 9442  | NATO |
| 1984          | 21600 | 241000 | 54.8 | 9510  | NATO |
| West Germany: |       |        |      |       |      |
| 1974          | 20180 | 151100 | 62.0 | 9007  | NATO |
| 1975          | 19940 | 164600 | 61.8 | 8879  | NATO |
| 1976          | 20000 | 171500 | 61.5 | 9396  | NATO |
| 1977          | 19900 | 175700 | 61.4 | 9682  | NATO |
| 1978          | 20520 | 180800 | 61.3 | 10040 | NATO |
| 1979          | 20880 | 186400 | 61.3 | 10480 | NATO |
| 1980          | 21390 | 199600 | 61.6 | 10650 | NATO |
| 1981          | 22080 | 206300 | 61.7 | 10620 | NATO |
| 1982          | 21930 | 206900 | 61.6 | 10500 | NATO |
| 1983          | 22130 | 207500 | 61.4 | 10680 | NATO |
| 1984          | 22020 | 210000 | 61.2 | 11020 | NATO |
| Greece:       |       |        |      |       |      |
| 1974          | 1467  | 7843   | 9.0  | 3026  | NATO |
| 1975          | 1903  | 8538   | 9.0  | 3165  | NATO |
| 1976          | 2045  | 9784   | 9.2  | 3328  | NATO |
| 1977          | 2157  | 10570  | 9.3  | 3401  | NATO |
| 1978          | 2196  | 11270  | 9.4  | 3571  | NATO |
| 1979          | 2132  | 11490  | 9.5  | 3661  | NATO |
| 1980          | 1954  | 12330  | 9.6  | 3695  | NATO |
| 1981          | 2404  | 13910  | 9.7  | 3641  | NATO |
| 1982          | 2377  | 12770  | 9.8  | 3596  | NATO |
| 1983          | 2195  | 14680  | 9.8  | 3555  | NATO |
| 1984          | 2575  | 15340  | 9.9  | 3613  | NATO |



| YR       | ME    | GE     | POP   | PI    | BK   |
|----------|-------|--------|-------|-------|------|
| <hr/>    |       |        |       |       |      |
| Ireland: |       |        |       |       |      |
| 1974     | 179   | 5880   | 3.1   | 4313  | WEST |
| 1975     | 249   | 6155   | 3.2   | 4303  | WEST |
| 1976     | 222   | 6392   | 3.2   | 4302  | WEST |
| 1977     | 236   | 6692   | 3.3   | 4510  | WEST |
| 1978     | 250   | 7419   | 3.3   | 4687  | WEST |
| 1979     | 253   | 8017   | 3.4   | 4701  | WEST |
| 1980     | 276   | 8834   | 3.4   | 4890  | WEST |
| 1981     | 270   | 9560   | 3.5   | 4933  | WEST |
| 1982     | 322   | 10300  | 3.5   | 4840  | WEST |
| 1983     | 312   | 10320  | 3.5   | 4781  | WEST |
| 1984     | 308   | 10390  | 3.6   | 4841  | WEST |
| Italy:   |       |        |       |       |      |
| 1974     | 7916  | 121200 | 55.2  | 5555  | NATO |
| 1975     | 7331  | 137500 | 55.6  | 5306  | NATO |
| 1976     | 7221  | 136800 | 55.8  | 5593  | NATO |
| 1977     | 7619  | 144100 | 56.1  | 5686  | NATO |
| 1978     | 7824  | 143900 | 56.2  | 5829  | NATO |
| 1979     | 8202  | 155700 | 56.4  | 6092  | NATO |
| 1980     | 8635  | 174900 | 56.5  | 6326  | NATO |
| 1981     | 8803  | 177600 | 56.5  | 6301  | NATO |
| 1982     | 9312  | 183500 | 56.6  | 6246  | NATO |
| 1983     | 9481  | 200800 | 56.8  | 6196  | NATO |
| 1984     | 9771  | 209000 | 57.0  | 6330  | NATO |
| Japan:   |       |        |       |       |      |
| 1974     | 6586  | 116700 | 110.2 | 7325  | WEST |
| 1975     | 7430  | 125200 | 111.6 | 7419  | WEST |
| 1976     | 7945  | 137000 | 112.8 | 7719  | WEST |
| 1977     | 8405  | 151700 | 113.9 | 8050  | WEST |
| 1978     | 9036  | 171000 | 114.9 | 8385  | WEST |
| 1979     | 9702  | 188000 | 115.9 | 8749  | WEST |
| 1980     | 9868  | 199000 | 116.8 | 9095  | WEST |
| 1981     | 10330 | 208600 | 117.6 | 9396  | WEST |
| 1982     | 10950 | 214400 | 118.4 | 9644  | WEST |
| 1983     | 11600 | 222100 | 119.3 | 9899  | WEST |
| 1984     | 12280 | 226700 | 120.0 | 10410 | WEST |

| YR           | ME   | GE    | POP  | PI    | BK   |
|--------------|------|-------|------|-------|------|
| <hr/>        |      |       |      |       |      |
| Luxembourg:  |      |       |      |       |      |
| 1974         | 26   | 1100  | 0.4  | 10750 | NATO |
| 1975         | 31   | 1379  | 0.4  | 10610 | NATO |
| 1976         | 32   | 1449  | 0.4  | 10900 | NATO |
| 1977         | 33   | 1596  | 0.4  | 11260 | NATO |
| 1978         | 35   | 1593  | 0.4  | 11740 | NATO |
| 1979         | 36   | 1679  | 0.4  | 12420 | NATO |
| 1980         | 42   | 1767  | 0.4  | 12210 | NATO |
| 1981         | 43   | 1818  | 0.4  | 12240 | NATO |
| 1982         | 42   | 1829  | 0.4  | 12690 | NATO |
| 1983         | 41   | 1833  | 0.4  | 12500 | NATO |
| 1984         | 41   | 1773  | 0.4  | 13030 | NATO |
| Netherlands: |      |       |      |       |      |
| 1974         | 3650 | 53470 | 13.5 | 8845  | NATO |
| 1975         | 3803 | 58600 | 13.7 | 8605  | NATO |
| 1976         | 3759 | 61340 | 13.8 | 9011  | NATO |
| 1977         | 4196 | 63810 | 13.9 | 9172  | NATO |
| 1978         | 4012 | 66830 | 13.9 | 9337  | NATO |
| 1979         | 4256 | 70500 | 14.0 | 9463  | NATO |
| 1980         | 4175 | 73520 | 14.1 | 9462  | NATO |
| 1981         | 4266 | 76150 | 14.2 | 9322  | NATO |
| 1982         | 4246 | 77750 | 14.3 | 9141  | NATO |
| 1983         | 4257 | 79910 | 14.4 | 9219  | NATO |
| 1984         | 4360 | 80450 | 14.4 | 9338  | NATO |
| New Zealand: |      |       |      |       |      |
| 1974         | 340  | 7413  | 3.0  | 6888  | WEST |
| 1975         | 354  | 8716  | 3.1  | 6813  | WEST |
| 1976         | 331  | 7660  | 3.1  | 6803  | WEST |
| 1977         | 348  | 8099  | 3.1  | 6500  | WEST |
| 1978         | 346  | 8494  | 3.1  | 6514  | WEST |
| 1979         | 339  | 7977  | 3.1  | 6617  | WEST |
| 1980         | 396  | 8249  | 3.1  | 6740  | WEST |
| 1981         | 449  | 8972  | 3.1  | 6947  | WEST |
| 1982         | 469  | 9312  | 3.2  | 6833  | WEST |
| 1983         | 466  | 9975  | 3.2  | 7050  | WEST |
| 1984         | 454  | 10120 | 3.2  | 7298  | WEST |

| YR        | ME   | GE    | POP  | PI    | BK   |
|-----------|------|-------|------|-------|------|
| <hr/>     |      |       |      |       |      |
| Norway:   |      |       |      |       |      |
| 1974      | 1210 | 15600 | 4.0  | 9859  | NATO |
| 1975      | 1332 | 16880 | 4.0  | 10230 | NATO |
| 1976      | 1372 | 19590 | 4.0  | 10720 | NATO |
| 1977      | 1417 | 20770 | 4.0  | 11030 | NATO |
| 1978      | 1537 | 21790 | 4.1  | 11380 | NATO |
| 1979      | 1549 | 22700 | 4.1  | 11850 | NATO |
| 1980      | 1513 | 22560 | 4.1  | 12380 | NATO |
| 1981      | 1525 | 21700 | 4.1  | 12460 | NATO |
| 1982      | 1602 | 22650 | 4.1  | 12420 | NATO |
| 1983      | 1699 | 22540 | 4.1  | 12890 | NATO |
| 1984      | 1623 | 22870 | 4.1  | 13400 | NATO |
| Portugal: |      |       |      |       |      |
| 1974      | 1192 | 3011  | 9.1  | 1790  | NATO |
| 1975      | 813  | 3571  | 9.4  | 1635  | NATO |
| 1976      | 662  | 4300  | 9.6  | 1693  | NATO |
| 1977      | 614  | 6216  | 9.7  | 1774  | NATO |
| 1978      | 625  | 5018  | 9.7  | 1812  | NATO |
| 1979      | 661  | 4856  | 9.8  | 1913  | NATO |
| 1980      | 700  | 5404  | 9.8  | 1975  | NATO |
| 1981      | 707  | 5851  | 9.9  | 1951  | NATO |
| 1982      | 711  | 6657  | 9.9  | 1974  | NATO |
| 1983      | 693  | 6973  | 9.9  | 1970  | NATO |
| 1984      | 658  | 6979  | 10.0 | 1894  | NATO |
| Spain:    |      |       |      |       |      |
| 1974      | 3666 | 29510 | 35.2 | 3979  | NATO |
| 1975      | 3805 | 32200 | 35.6 | 3968  | NATO |
| 1976      | 3553 | 31530 | 36.0 | 4028  | NATO |
| 1977      | 2603 | 37460 | 36.4 | 4105  | NATO |
| 1978      | 2594 | 39970 | 36.9 | 4132  | NATO |
| 1979      | 2767 | 42850 | 37.2 | 4118  | NATO |
| 1980      | 2949 | 45330 | 37.5 | 4141  | NATO |
| 1981      | 3039 | 50460 | 37.8 | 4076  | NATO |
| 1982      | 3227 | 34720 | 38.1 | 4060  | NATO |
| 1983      | 3335 | 42040 | 38.3 | 4065  | NATO |
| 1984      | 3512 | 45900 | 38.6 | 4119  | NATO |

| YR           | ME   | GE    | POP  | PI    | BK   |
|--------------|------|-------|------|-------|------|
| <hr/>        |      |       |      |       |      |
| Sweden:      |      |       |      |       |      |
| 1974         | 2779 | 27940 | 8.2  | 10060 | WEST |
| 1975         | 2731 | 28270 | 8.2  | 10240 | WEST |
| 1976         | 2693 | 31030 | 8.2  | 10310 | WEST |
| 1977         | 2559 | 33190 | 8.3  | 10040 | WEST |
| 1978         | 2676 | 35990 | 8.3  | 10130 | WEST |
| 1979         | 2780 | 38250 | 8.3  | 10550 | WEST |
| 1980         | 2736 | 39020 | 8.3  | 10650 | WEST |
| 1981         | 2779 | 41160 | 8.3  | 10510 | WEST |
| 1982         | 2863 | 41980 | 8.3  | 10530 | WEST |
| 1983         | 2888 | 44770 | 8.3  | 10760 | WEST |
| 1984         | 2831 | 44430 | 8.3  | 11050 | WEST |
| Switzerland: |      |       |      |       |      |
| 1974         | 1890 | 16130 | 6.5  | 15330 | WEST |
| 1975         | 1775 | 16870 | 6.4  | 14250 | WEST |
| 1976         | 1991 | 18450 | 6.3  | 14270 | WEST |
| 1977         | 1905 | 18650 | 6.3  | 14730 | WEST |
| 1978         | 1863 | 18720 | 6.3  | 14710 | WEST |
| 1979         | 1980 | 19250 | 6.4  | 15080 | WEST |
| 1980         | 1994 | 19730 | 6.4  | 15680 | WEST |
| 1981         | 1983 | 19430 | 6.4  | 15930 | WEST |
| 1982         | 2034 | 19820 | 6.5  | 15610 | WEST |
| 1983         | 2055 | 20420 | 6.5  | 15730 | WEST |
| 1984         | 2130 | 21240 | 6.4  | 16220 | WEST |
| Turkey:      |      |       |      |       |      |
| 1974         | 1388 | 6943  | 39.5 | 904   | NATO |
| 1975         | 2278 | 8749  | 40.5 | 962   | NATO |
| 1976         | 2607 | 10060 | 41.5 | 1018  | NATO |
| 1977         | 2562 | 12330 | 42.4 | 1040  | NATO |
| 1978         | 2373 | 12390 | 43.3 | 1045  | NATO |
| 1979         | 1958 | 13300 | 44.2 | 1009  | NATO |
| 1980         | 1928 | 11610 | 45.1 | 977   | NATO |
| 1981         | 2291 | 11440 | 46.2 | 991   | NATO |
| 1982         | 2562 | 11870 | 47.3 | 1014  | NATO |
| 1983         | 2469 | 12390 | 48.4 | 1027  | NATO |
| 1984         | 2385 | 13550 | 49.5 | 1061  | NATO |



| YR              | ME     | GE     | POP   | PI    | BK   |
|-----------------|--------|--------|-------|-------|------|
| <hr/>           |        |        |       |       |      |
| United Kingdom: |        |        |       |       |      |
| 1974            | 20590  | 164800 | 56.2  | 7366  | NATO |
| 1975            | 20150  | 177600 | 56.2  | 7262  | NATO |
| 1976            | 20860  | 175000 | 56.2  | 7523  | NATO |
| 1977            | 20320  | 165300 | 56.2  | 7612  | NATO |
| 1978            | 20490  | 172900 | 56.2  | 7888  | NATO |
| 1979            | 21100  | 178100 | 56.2  | 8019  | NATO |
| 1980            | 22010  | 178800 | 56.3  | 7799  | NATO |
| 1981            | 20770  | 178600 | 56.4  | 7684  | NATO |
| 1982            | 22040  | 186600 | 56.3  | 7806  | NATO |
| 1983            | 24170  | 193700 | 56.4  | 8088  | NATO |
| 1984            | 24570  | 193000 | 56.4  | 8270  | NATO |
| United States:  |        |        |       |       |      |
| 1974            | 163400 | 539100 | 213.9 | 13100 | NATO |
| 1975            | 157900 | 601700 | 216.0 | 12850 | NATO |
| 1976            | 148700 | 630800 | 218.0 | 13360 | NATO |
| 1977            | 155600 | 653300 | 220.2 | 13930 | NATO |
| 1978            | 155800 | 678200 | 222.6 | 14410 | NATO |
| 1979            | 161400 | 692700 | 225.1 | 14710 | NATO |
| 1980            | 174200 | 753000 | 227.7 | 14520 | NATO |
| 1981            | 190200 | 804600 | 230.0 | 14860 | NATO |
| 1982            | 205400 | 821700 | 232.3 | 14250 | NATO |
| 1983            | 217200 | 856000 | 234.5 | 14520 | NATO |
| 1984            | 229200 | 866900 | 236.7 | 15380 | NATO |
| Israel:         |        |        |       |       |      |
| 1974            | 5352   | 13660  | 3.3   | 6206  | LDC  |
| 1975            | 6155   | 14810  | 3.4   | 6257  | LDC  |
| 1976            | 6340   | 15920  | 3.4   | 6202  | LDC  |
| 1977            | 5976   | 16490  | 3.5   | 6122  | LDC  |
| 1978            | 5181   | 15570  | 3.6   | 6263  | LDC  |
| 1979            | 6922   | 18950  | 3.7   | 6458  | LDC  |
| 1980            | 7364   | 20000  | 3.8   | 6441  | LDC  |
| 1981            | 6225   | 21770  | 3.8   | 6648  | LDC  |
| 1982            | 5707   | 21400  | 3.9   | 6564  | LDC  |
| 1983            | 6308   | 27050  | 4.0   | 6585  | LDC  |
| 1984            | 6966   | 26650  | 4.0   | 6345  | LDC  |

| YR           | ME   | GE    | POP  | PI   | BK  |
|--------------|------|-------|------|------|-----|
| <hr/>        |      |       |      |      |     |
| South Korea: |      |       |      |      |     |
| 1974         | 1723 | 6458  | 36.0 | 1102 | LDC |
| 1975         | 1985 | 7532  | 36.7 | 1158 | LDC |
| 1976         | 2728 | 8919  | 37.3 | 1300 | LDC |
| 1977         | 3083 | 10010 | 37.9 | 1442 | LDC |
| 1978         | 3608 | 11060 | 38.4 | 1558 | LDC |
| 1979         | 3309 | 12410 | 39.0 | 1636 | LDC |
| 1980         | 3714 | 12670 | 39.6 | 1529 | LDC |
| 1981         | 4044 | 14560 | 40.1 | 1606 | LDC |
| 1982         | 4238 | 15590 | 40.7 | 1668 | LDC |
| 1983         | 4390 | 15730 | 41.4 | 1838 | LDC |
| 1984         | 4437 | 16690 | 42.0 | 1963 | LDC |
| Malta:       |      |       |      |      |     |
| 1974         | 6    | 258   | 0.3  | 1656 | LDC |
| 1975         | 10   | 347   | 0.3  | 1978 | LDC |
| 1976         | 9    | 338   | 0.3  | 2263 | LDC |
| 1977         | 10   | 327   | 0.3  | 2498 | LDC |
| 1978         | 9    | 352   | 0.3  | 2681 | LDC |
| 1979         | *    | *     | 0.3  | 2867 | LDC |
| 1980         | 6    | 360   | 0.4  | 3005 | LDC |
| 1981         | 8    | 424   | 0.4  | 3134 | LDC |
| 1982         | 11   | 460   | 0.4  | 3266 | LDC |
| 1983         | 13   | 467   | 0.4  | 3202 | LDC |
| 1984         | 11   | 442   | 0.4  | 3279 | LDC |
| Argentina:   |      |       |      |      |     |
| 1974         | 1049 | 14440 | 25.6 | 2480 | LDC |
| 1975         | 1357 | 13570 | 26.1 | 2428 | LDC |
| 1976         | 1989 | 12410 | 26.5 | 2373 | LDC |
| 1977         | 2155 | 11460 | 26.9 | 2483 | LDC |
| 1978         | 1952 | 12630 | 27.4 | 2359 | LDC |
| 1979         | 2237 | 13560 | 27.9 | 2473 | LDC |
| 1980         | 2463 | 14560 | 28.3 | 2440 | LDC |
| 1981         | 2374 | 16060 | 28.8 | 2183 | LDC |
| 1982         | 3620 | 13980 | 29.3 | 2001 | LDC |
| 1983         | 2745 | 18360 | 29.7 | 2009 | LDC |
| 1984         | 2250 | 13050 | 30.2 | 2024 | LDC |

| YR                 | ME   | GE    | POP   | PI   | BK  |
|--------------------|------|-------|-------|------|-----|
| <b>Bangladesh:</b> |      |       |       |      |     |
| 1974               | 86   | 863   | 74.7  | 110  | LDC |
| 1975               | 69   | 647   | 76.2  | 11   | LDC |
| 1976               | 145  | 1359  | 77.9  | 12   | LDC |
| 1977               | 209  | 1701  | 80.4  | 10   | LDC |
| 1978               | 208  | 1606  | 82.9  | 14   | LDC |
| 1979               | 154  | 1726  | 85.5  | 16   | LDC |
| 1980               | 160  | 2072  | 88.1  | 14   | LDC |
| 1981               | 176  | 1893  | 90.6  | 18   | LDC |
| 1982               | 200  | 1918  | 93.3  | 15   | LDC |
| 1983               | 260  | 2011  | 95.9  | 16   | LDC |
| 1984               | 239  | 2479  | 98.6  | 18   | LDC |
| <b>Bolivia:</b>    |      |       |       |      |     |
| 1974               | 92   | 614   | 4.7   | 1172 | LDC |
| 1975               | 122  | 691   | 4.8   | 1226 | LDC |
| 1976               | 131  | 815   | 4.9   | 1268 | LDC |
| 1977               | 126  | 854   | 5.1   | 1277 | LDC |
| 1978               | 148  | 917   | 5.2   | 1281 | LDC |
| 1979               | 150  | 903   | 5.3   | 1232 | LDC |
| 1980               | 176  | 977   | 5.4   | 1174 | LDC |
| 1981               | 210  | 927   | 5.6   | 1136 | LDC |
| 1982               | 105  | 1418  | 5.7   | 953  | LDC |
| 1983               | 74   | 694   | 5.9   | 924  | LDC |
| 1984               | 116  | 2157  | 6.0   | 893  | LDC |
| <b>Brazil:</b>     |      |       |       |      |     |
| 1974               | 1814 | 27080 | 106.0 | 1375 | LDC |
| 1975               | 1726 | 31010 | 108.7 | 1408 | LDC |
| 1976               | 1996 | 34150 | 111.3 | 1506 | LDC |
| 1977               | 1692 | 42400 | 114.0 | 1552 | LDC |
| 1978               | 1556 | 45100 | 116.9 | 1588 | LDC |
| 1979               | 1419 | 44750 | 119.9 | 1643 | LDC |
| 1980               | 1441 | 51020 | 123.0 | 1708 | LDC |
| 1981               | 1424 | 55550 | 126.3 | 1623 | LDC |
| 1982               | 1917 | 59650 | 129.6 | 1579 | LDC |
| 1983               | 1726 | 61420 | 132.9 | 1479 | LDC |
| 1984               | 1719 | 60570 | 136.3 | 1505 | LDC |

| YR                                   | ME   | GE    | POP  | PI   | BK  |
|--------------------------------------|------|-------|------|------|-----|
| <hr/>                                |      |       |      |      |     |
| Bulgaria:                            |      |       |      |      |     |
| 1974                                 | 3827 | 17240 | 8.7  | 5198 | WTO |
| 1975                                 | 3786 | 19200 | 8.7  | 5615 | WTO |
| 1976                                 | 3880 | 17660 | 8.8  | 5765 | WTO |
| 1977                                 | 3944 | 17590 | 8.8  | 5718 | WTO |
| 1978                                 | 3755 | 19670 | 8.8  | 5788 | WTO |
| 1979                                 | 3752 | 19940 | 8.8  | 6051 | WTO |
| 1980                                 | 3777 | 19480 | 8.9  | 5850 | WTO |
| 1981                                 | 3902 | 22720 | 8.9  | 6075 | WTO |
| 1982                                 | 4327 | 23380 | 8.9  | 6210 | WTO |
| 1983                                 | 4310 | 22430 | 8.9  | 6043 | WTO |
| 1984                                 | 4381 | 23080 | 9.0  | 6231 | WTO |
| Burkina Faso (formerly Upper Volta): |      |       |      |      |     |
| 1974                                 | 10   | 89    | 5.5  | 148  | LDC |
| 1975                                 | 23   | 110   | 5.6  | 147  | LDC |
| 1976                                 | 26   | 129   | 5.7  | 158  | LDC |
| 1977                                 | 27   | 128   | 5.8  | 155  | LDC |
| 1978                                 | 30   | 128   | 5.9  | 163  | LDC |
| 1979                                 | 26   | 158   | 6.0  | 172  | LDC |
| 1980                                 | 26   | 149   | 6.1  | 174  | LDC |
| 1981                                 | 29   | 165   | 6.3  | 178  | LDC |
| 1982                                 | 30   | 169   | 6.4  | 174  | LDC |
| 1983                                 | 29   | 145   | 6.6  | 167  | LDC |
| 1984                                 | 29   | 168   | 6.7  | 162  | LDC |
| Burma:                               |      |       |      |      |     |
| 1974                                 | 138  | 500   | 29.6 | 125  | LDC |
| 1975                                 | 140  | 492   | 30.2 | 128  | LDC |
| 1976                                 | 145  | 528   | 30.8 | 133  | LDC |
| 1977                                 | 159  | 607   | 31.4 | 137  | LDC |
| 1978                                 | 161  | 696   | 32.1 | 143  | LDC |
| 1979                                 | 173  | 708   | 32.7 | 147  | LDC |
| 1980                                 | 183  | 833   | 33.4 | 157  | LDC |
| 1981                                 | 199  | 894   | 34.1 | 163  | LDC |
| 1982                                 | 188  | 976   | 34.8 | 168  | LDC |
| 1983                                 | 190  | 954   | 35.5 | 171  | LDC |
| 1984                                 | 189  | 987   | 36.2 | 177  | LDC |



| YR                        | ME  | GE   | POP  | PI   | BK  |
|---------------------------|-----|------|------|------|-----|
| <hr/>                     |     |      |      |      |     |
| Cameroon:                 |     |      |      |      |     |
| 1974                      | 47  | 458  | 7.3  | 428  | LDC |
| 1975                      | 51  | 577  | 7.5  | 416  | LDC |
| 1976                      | 59  | 643  | 7.7  | 425  | LDC |
| 1977                      | 51  | 629  | 7.9  | 454  | LDC |
| 1978                      | 63  | 734  | 8.1  | 494  | LDC |
| 1979                      | 69  | 756  | 8.3  | 538  | LDC |
| 1980                      | 75  | 824  | 8.6  | 598  | LDC |
| 1981                      | 63  | 1247 | 8.8  | 660  | LDC |
| 1982                      | 67  | 1311 | 9.0  | 681  | LDC |
| 1983                      | 137 | 1674 | 9.2  | 705  | LDC |
| 1984                      | 134 | 1691 | 9.5  | 727  | LDC |
| Central African Republic: |     |      |      |      |     |
| 1974                      | 14  | 159  | 2.0  | 331  | LDC |
| 1975                      | 13  | 149  | 2.0  | 325  | LDC |
| 1976                      | 13  | 121  | 2.1  | 331  | LDC |
| 1977                      | 14  | 133  | 2.1  | 335  | LDC |
| 1978                      | 14  | 134  | 2.2  | 335  | LDC |
| 1979                      | 14  | 132  | 2.3  | 318  | LDC |
| 1980                      | 14  | 124  | 2.3  | 298  | LDC |
| 1981                      | 15  | 124  | 2.4  | 284  | LDC |
| 1982                      | 15  | 147  | 2.4  | 283  | LDC |
| 1983                      | 13  | 139  | 2.5  | 258  | LDC |
| 1984                      | *   | *    | 2.6  | 273  | LDC |
| Chile:                    |     |      |      |      |     |
| 1974                      | 838 | 5895 | 10.0 | 1713 | LDC |
| 1975                      | 700 | 5334 | 10.2 | 1432 | LDC |
| 1976                      | 620 | 4812 | 10.4 | 1468 | LDC |
| 1977                      | 680 | 5699 | 10.5 | 1598 | LDC |
| 1978                      | 766 | 6069 | 10.7 | 1703 | LDC |
| 1979                      | 713 | 5944 | 10.9 | 1810 | LDC |
| 1980                      | 757 | 6268 | 11.0 | 1914 | LDC |
| 1981                      | 828 | 6977 | 11.2 | 1964 | LDC |
| 1982                      | 776 | 6192 | 11.4 | 1594 | LDC |
| 1983                      | 759 | 6000 | 11.6 | 1563 | LDC |
| 1984                      | 790 | 6659 | 11.8 | 1597 | LDC |

| YR              | ME   | GE    | POP  | PI   | BK  |
|-----------------|------|-------|------|------|-----|
| <hr/>           |      |       |      |      |     |
| Colombia:       |      |       |      |      |     |
| 1974            | 277  | 3305  | 23.6 | 1161 | LDC |
| 1975            | 338  | 3670  | 24.1 | 1158 | LDC |
| 1976            | 273  | 3261  | 24.6 | 1187 | LDC |
| 1977            | 223  | 3450  | 25.1 | 1221 | LDC |
| 1978            | 244  | 3879  | 25.5 | 1304 | LDC |
| 1979            | 341  | 4478  | 26.0 | 1355 | LDC |
| 1980            | 394  | 5119  | 26.5 | 1387 | LDC |
| 1981            | 380  | 5494  | 27.0 | 1383 | LDC |
| 1982            | 458  | 5746  | 27.6 | 1355 | LDC |
| 1983            | 505  | 5453  | 28.2 | 1343 | LDC |
| 1984            | 555  | 5569  | 28.7 | 1344 | LDC |
| Czechoslovakia: |      |       |      |      |     |
| 1974            | 6286 | 32870 | 14.7 | 7110 | WTO |
| 1975            | 6449 | 35900 | 14.8 | 7280 | WTO |
| 1976            | 6239 | 37610 | 14.9 | 7365 | WTO |
| 1977            | 6306 | 99630 | 15.0 | 7679 | WTO |
| 1978            | 6370 | 36540 | 15.1 | 7689 | WTO |
| 1979            | 6267 | 36640 | 15.2 | 7768 | WTO |
| 1980            | 6518 | 37400 | 15.3 | 7904 | WTO |
| 1981            | 6731 | 40820 | 15.3 | 7944 | WTO |
| 1982            | 7202 | 39260 | 15.4 | 8024 | WTO |
| 1983            | 7271 | 40280 | 15.4 | 8070 | WTO |
| 1984            | 7388 | 40950 | 15.5 | 8298 | WTO |
| Ecuador:        |      |       |      |      |     |
| 1974            | 173  | 1055  | 6.8  | 1181 | LDC |
| 1975            | 214  | 1100  | 7.0  | 1260 | LDC |
| 1976            | 235  | 1254  | 7.2  | 1326 | LDC |
| 1977            | 236  | 1412  | 7.5  | 1378 | LDC |
| 1978            | 310  | 1256  | 7.7  | 1425 | LDC |
| 1979            | 269  | 1246  | 7.9  | 1437 | LDC |
| 1980            | 265  | 1766  | 8.1  | 1454 | LDC |
| 1981            | 274  | 2080  | 8.4  | 1464 | LDC |
| 1982            | 245  | 2028  | 8.6  | 1406 | LDC |
| 1983            | 200  | 1683  | 8.9  | 1327 | LDC |
| 1984            | 197  | 1737  | 9.1  | 1313 | LDC |

| YR            | ME    | GE    | POP  | PI   | BK  |
|---------------|-------|-------|------|------|-----|
| <hr/>         |       |       |      |      |     |
| East Germany: |       |       |      |      |     |
| 1974          | 7789  | 55770 | 16.9 | 7636 | WTO |
| 1975          | 8136  | 57610 | 16.9 | 7974 | WTO |
| 1976          | 8277  | 60650 | 16.8 | 8177 | WTO |
| 1977          | 8367  | 63000 | 16.8 | 8492 | WTO |
| 1978          | 8494  | 66010 | 16.8 | 8577 | WTO |
| 1979          | 8643  | 69600 | 16.7 | 8894 | WTO |
| 1980          | 8791  | 73050 | 16.7 | 9074 | WTO |
| 1981          | 9197  | 76790 | 16.7 | 9399 | WTO |
| 1982          | 9720  | 81420 | 16.7 | 9321 | WTO |
| 1983          | 9966  | 84690 | 16.7 | 9420 | WTO |
| 1984          | 10330 | 89010 | 16.7 | 9769 | WTO |
| Guyana:       |       |       |      |      |     |
| 1974          | 14    | 198   | 0.8  | 688  | LDC |
| 1975          | 39    | 296   | 0.8  | 768  | LDC |
| 1976          | 47    | 389   | 0.8  | 768  | LDC |
| 1977          | 33    | 276   | 0.8  | 750  | LDC |
| 1978          | 21    | 249   | 0.8  | 743  | LDC |
| 1979          | 19    | 313   | 0.8  | 726  | LDC |
| 1980          | 22    | 386   | 0.8  | 728  | LDC |
| 1981          | 24    | 424   | 0.8  | 712  | LDC |
| 1982          | 27    | *     | 0.8  | 628  | LDC |
| 1983          | 22    | 380   | 0.8  | 596  | LDC |
| 1984          | 23    | *     | 0.8  | 632  | LDC |
| Hungary:      |       |       |      |      |     |
| 1974          | 3216  | 31480 | 10.5 | 6085 | WTO |
| 1975          | 3171  | 36100 | 10.5 | 6194 | WTO |
| 1976          | 2906  | 35020 | 10.6 | 6188 | WTO |
| 1977          | 2840  | 35980 | 10.6 | 6591 | WTO |
| 1978          | 2963  | 36040 | 10.7 | 6679 | WTO |
| 1979          | 2939  | 36600 | 10.7 | 6732 | WTO |
| 1980          | 3195  | 40040 | 10.7 | 6787 | WTO |
| 1981          | 3263  | 42370 | 10.7 | 6936 | WTO |
| 1982          | 3257  | 41120 | 10.7 | 7152 | WTO |
| 1983          | 3197  | 42100 | 10.7 | 7044 | WTO |
| 1984          | 3177  | 41790 | 10.7 | 7277 | WTO |

| YR         | ME   | GE    | POP   | PI  | BK  |
|------------|------|-------|-------|-----|-----|
| <hr/>      |      |       |       |     |     |
| India:     |      |       |       |     |     |
| 1974       | 3689 | 17530 | 607.7 | 200 | LDC |
| 1975       | 4338 | 22880 | 621.0 | 215 | LDC |
| 1976       | 4824 | 24120 | 634.4 | 214 | LDC |
| 1977       | 5346 | 25340 | 647.5 | 227 | LDC |
| 1978       | 5646 | 29360 | 660.7 | 237 | LDC |
| 1979       | 5235 | 29180 | 674.5 | 221 | LDC |
| 1980       | 5441 | 31620 | 689.0 | 232 | LDC |
| 1981       | 5966 | 32600 | 704.2 | 238 | LDC |
| 1982       | 6222 | 35660 | 719.8 | 242 | LDC |
| 1983       | 6776 | 37990 | 735.6 | 254 | LDC |
| 1984       | 6903 | 44240 | 751.6 | 258 | LDC |
| Indonesia: |      |       |       |     |     |
| 1974       | 1331 | 8080  | 134.3 | 331 | LDC |
| 1975       | 1778 | 9932  | 137.5 | 339 | LDC |
| 1976       | 1757 | 11470 | 140.8 | 359 | LDC |
| 1977       | 1791 | 11120 | 144.3 | 378 | LDC |
| 1978       | 1913 | 12740 | 147.8 | 395 | LDC |
| 1979       | 1995 | 14580 | 151.4 | 405 | LDC |
| 1980       | 2089 | 16460 | 154.9 | 433 | LDC |
| 1981       | 2351 | 19380 | 158.5 | 463 | LDC |
| 1982       | 2373 | 17670 | 162.1 | 464 | LDC |
| 1983       | 2125 | 19130 | 165.8 | 467 | LDC |
| 1984       | 2138 | 17210 | 169.4 | 484 | LDC |
| Kenya:     |      |       |       |     |     |
| 1974       | 53   | 804   | 13.0  | 294 | LDC |
| 1975       | 64   | 955   | 13.5  | 287 | LDC |
| 1976       | 58   | 993   | 14.0  | 279 | LDC |
| 1977       | 103  | 928   | 14.6  | 294 | LDC |
| 1978       | 186  | 1286  | 15.2  | 302 | LDC |
| 1979       | 233  | 1444  | 15.8  | 305 | LDC |
| 1980       | 223  | 1458  | 16.4  | 309 | LDC |
| 1981       | 166  | 1657  | 17.1  | 315 | LDC |
| 1982       | 211  | 1707  | 17.8  | 302 | LDC |
| 1983       | 207  | 1537  | 18.6  | 299 | LDC |
| 1984       | 190  | 1512  | 19.4  | 287 | LDC |



| YR        | ME   | GE    | POP  | PI   | BK  |
|-----------|------|-------|------|------|-----|
| <hr/>     |      |       |      |      |     |
| Malaysia: |      |       |      |      |     |
| 1974      | 659  | 4144  | 12.0 | 1316 | LDC |
| 1975      | 752  | 4928  | 12.3 | 1314 | LDC |
| 1976      | 706  | 5125  | 12.6 | 1422 | LDC |
| 1977      | 927  | 6021  | 12.8 | 1495 | LDC |
| 1978      | 790  | 6276  | 13.1 | 1548 | LDC |
| 1979      | 853  | 5939  | 13.4 | 1651 | LDC |
| 1980      | 1059 | 8098  | 13.8 | 1762 | LDC |
| 1981      | 1556 | 11400 | 14.1 | 1848 | LDC |
| 1982      | 1616 | 13420 | 14.4 | 1882 | LDC |
| 1983      | 1443 | 12210 | 14.8 | 1910 | LDC |
| 1984      | 1154 | 11210 | 15.1 | 1990 | LDC |
| Mali:     |      |       |      |      |     |
| 1974      | 17   | 87    | 6.1  | 125  | LDC |
| 1975      | 20   | 95    | 6.2  | 138  | LDC |
| 1976      | 24   | 123   | 6.3  | 154  | LDC |
| 1977      | 27   | 145   | 6.5  | 162  | LDC |
| 1978      | 27   | 150   | 6.6  | 156  | LDC |
| 1979      | 27   | 157   | 6.8  | 169  | LDC |
| 1980      | 26   | 246   | 6.9  | 163  | LDC |
| 1981      | 25   | 248   | 7.1  | 154  | LDC |
| 1982      | 27   | 322   | 7.2  | 160  | LDC |
| 1983      | 27   | 340   | 7.4  | 149  | LDC |
| 1984      | 23   | *     | 7.6  | 143  | LDC |
| Mexico:   |      |       |      |      |     |
| 1974      | 595  | 13930 | 59.7 | 1592 | LDC |
| 1975      | 771  | 17360 | 61.5 | 1634 | LDC |
| 1976      | 709  | 18070 | 63.2 | 1650 | LDC |
| 1977      | 695  | 18030 | 64.9 | 1664 | LDC |
| 1978      | 561  | 19710 | 66.6 | 1754 | LDC |
| 1979      | 614  | 22960 | 68.4 | 1859 | LDC |
| 1980      | 570  | 26600 | 70.1 | 1941 | LDC |
| 1981      | 757  | 33230 | 71.9 | 2025 | LDC |
| 1982      | 725  | 47500 | 73.8 | 1893 | LDC |
| 1983      | 726  | 38180 | 75.7 | 1759 | LDC |
| 1984      | 934  | 35370 | 77.7 | 1795 | LDC |

| YR       | ME   | GE    | POP  | PI   | BK  |
|----------|------|-------|------|------|-----|
| <hr/>    |      |       |      |      |     |
| Nepal:   |      |       |      |      |     |
| 1974     | 12   | 188   | 13.0 | 152  | LDC |
| 1975     | 12   | 182   | 13.3 | 151  | LDC |
| 1976     | 16   | 224   | 13.6 | 154  | LDC |
| 1977     | 20   | 281   | 13.9 | 155  | LDC |
| 1978     | 19   | 292   | 14.3 | 158  | LDC |
| 1979     | 20   | 301   | 14.6 | 158  | LDC |
| 1980     | 21   | 319   | 15.0 | 151  | LDC |
| 1981     | 23   | 353   | 15.4 | 159  | LDC |
| 1982     | 23   | 425   | 15.8 | 161  | LDC |
| 1983     | 28   | 494   | 16.2 | 152  | LDC |
| 1984     | 31   | 495   | 16.6 | 159  | LDC |
| Nigeria: |      |       |      |      |     |
| 1974     | 2161 | 15830 | 74.8 | 984  | LDC |
| 1975     | 4016 | 25580 | 77.1 | 939  | LDC |
| 1976     | 3094 | 26680 | 79.5 | 1007 | LDC |
| 1977     | 3441 | 27900 | 81.9 | 1038 | LDC |
| 1978     | 2880 | 25590 | 84.5 | 956  | LDC |
| 1979     | 2385 | 27400 | 87.2 | 980  | LDC |
| 1980     | 2371 | 25390 | 90.0 | 965  | LDC |
| 1981     | 2271 | 16590 | 93.0 | 884  | LDC |
| 1982     | 1839 | 18980 | 95.9 | 827  | LDC |
| 1983     | 1644 | 16110 | 97.7 | 755  | LDC |
| 1984     | 1170 | 13040 | 99.9 | 697  | LDC |
| Oman:    |      |       |      |      |     |
| 1974     | 650  | 2028  | 0.7  | 3094 | LDC |
| 1975     | 1213 | 2355  | 0.8  | 3872 | LDC |
| 1976     | 1283 | 2652  | 0.8  | 4354 | LDC |
| 1977     | 1059 | 2315  | 0.8  | 4345 | LDC |
| 1978     | 1095 | 2161  | 0.9  | 3909 | LDC |
| 1979     | 1029 | 2172  | 0.9  | 4741 | LDC |
| 1980     | 1428 | 2877  | 1.0  | 6613 | LDC |
| 1981     | 1694 | 3497  | 1.0  | 7165 | LDC |
| 1982     | 1762 | 3711  | 1.1  | 6695 | LDC |
| 1983     | 1944 | 3961  | 1.1  | 6226 | LDC |
| 1984     | 2040 | 4375  | 1.2  | 6245 | LDC |

| YR                | ME   | GE   | POP  | PI   | BK  |
|-------------------|------|------|------|------|-----|
| <hr/>             |      |      |      |      |     |
| Pakistan:         |      |      |      |      |     |
| 1974              | 1034 | 3659 | 72.9 | 251  | LDC |
| 1975              | 1153 | 4352 | 74.7 | 253  | LDC |
| 1976              | 1193 | 4568 | 76.5 | 260  | LDC |
| 1977              | 1083 | 4551 | 78.2 | 266  | LDC |
| 1978              | 1165 | 4762 | 80.1 | 284  | LDC |
| 1979              | 1189 | 5507 | 82.4 | 290  | LDC |
| 1980              | 1292 | 5469 | 85.2 | 306  | LDC |
| 1981              | 1403 | 5909 | 88.4 | 316  | LDC |
| 1982              | 1568 | 5770 | 91.5 | 318  | LDC |
| 1983              | 1934 | 6671 | 94.1 | 332  | LDC |
| 1984              | 1923 | 7126 | 96.6 | 338  | LDC |
| Papua New Guinea: |      |      |      |      |     |
| 1974              | *    | *    | *    | *    | LDC |
| 1975              | *    | *    | *    | *    | LDC |
| 1976              | 31   | 676  | 2.7  | 768  | LDC |
| 1977              | 29   | 676  | 2.8  | 764  | LDC |
| 1978              | 33   | 765  | 2.8  | 813  | LDC |
| 1979              | 31   | 758  | 2.9  | 797  | LDC |
| 1980              | 35   | 811  | 3.0  | 741  | LDC |
| 1981              | 36   | 919  | 3.1  | 743  | LDC |
| 1982              | 34   | 869  | 3.1  | 714  | LDC |
| 1983              | 34   | 848  | 3.2  | 703  | LDC |
| 1984              | 39   | 833  | 3.3  | 704  | LDC |
| Paraguay:         |      |      |      |      |     |
| 1974              | 46   | 352  | 2.8  | 1263 | LDC |
| 1975              | 70   | 431  | 2.9  | 1308 | LDC |
| 1976              | 72   | 492  | 3.0  | 1353 | LDC |
| 1977              | 79   | 516  | 3.1  | 1487 | LDC |
| 1978              | 81   | 589  | 3.2  | 1576 | LDC |
| 1979              | 82   | 611  | 3.3  | 1708 | LDC |
| 1980              | 90   | 674  | 3.4  | 1825 | LDC |
| 1981              | 105  | 791  | 3.5  | 1928 | LDC |
| 1982              | 120  | 749  | 3.6  | 1852 | LDC |
| 1983              | 163  | 728  | 3.7  | 1736 | LDC |
| 1984              | 114  | 791  | 3.9  | 1753 | LDC |

| YR           | ME    | GE    | POP  | PI   | BK  |
|--------------|-------|-------|------|------|-----|
| <hr/>        |       |       |      |      |     |
| Peru:        |       |       |      |      |     |
| 1974         | 569   | 2808  | 14.8 | 1239 | LDC |
| 1975         | 757   | 3172  | 15.2 | 1246 | LDC |
| 1976         | 882   | 3352  | 15.6 | 1224 | LDC |
| 1977         | 1291  | 3282  | 16.0 | 1191 | LDC |
| 1978         | 969   | 3026  | 16.4 | 1076 | LDC |
| 1979         | 621   | 2903  | 16.8 | 1159 | LDC |
| 1980         | 1030  | 3811  | 17.3 | 1207 | LDC |
| 1981         | 924   | 3899  | 17.8 | 1227 | LDC |
| 1982         | 1015  | 3363  | 18.2 | 1199 | LDC |
| 1983         | 921   | 3069  | 18.7 | 1008 | LDC |
| 1984         | 1402  | 2962  | 19.2 | 1021 | LDC |
| Philippines: |       |       |      |      |     |
| 1974         | 433   | 2614  | 43.3 | 515  | LDC |
| 1975         | 732   | 3761  | 44.4 | 532  | LDC |
| 1976         | 778   | 3900  | 45.6 | 555  | LDC |
| 1977         | 761   | 4004  | 46.8 | 576  | LDC |
| 1978         | 572   | 4218  | 48.0 | 594  | LDC |
| 1979         | 699   | 4150  | 49.3 | 619  | LDC |
| 1980         | 619   | 4570  | 50.5 | 634  | LDC |
| 1981         | 602   | 5219  | 51.7 | 639  | LDC |
| 1982         | 558   | 5267  | 53.0 | 636  | LDC |
| 1983         | 549   | 4776  | 54.3 | 628  | LDC |
| 1984         | 383   | 4031  | 55.5 | 572  | LDC |
| Poland:      |       |       |      |      |     |
| 1974         | 10740 | 50100 | 33.6 | 6027 | WTO |
| 1975         | 11030 | 61500 | 34.0 | 6265 | WTO |
| 1976         | 11450 | 61320 | 34.3 | 6368 | WTO |
| 1977         | 11710 | 66730 | 34.6 | 6471 | WTO |
| 1978         | 11440 | 71510 | 34.9 | 6588 | WTO |
| 1979         | 11480 | 78320 | 35.3 | 6463 | WTO |
| 1980         | 11570 | 83670 | 35.6 | 6245 | WTO |
| 1981         | 11500 | 86630 | 35.9 | 5947 | WTO |
| 1982         | 12920 | 60530 | 36.2 | 5798 | WTO |
| 1983         | 12240 | 52550 | 36.6 | 5986 | WTO |
| 1984         | 12990 | 58080 | 36.9 | 6159 | WTO |



| YR         | ME   | GE    | POP  | PI   | BK  |
|------------|------|-------|------|------|-----|
| <hr/>      |      |       |      |      |     |
| Romania:   |      |       |      |      |     |
| 1974       | 4848 | 35260 | 21.0 | 4006 | WTO |
| 1975       | 4951 | 38400 | 21.2 | 4151 | WTO |
| 1976       | 5111 | 41230 | 21.4 | 4562 | WTO |
| 1977       | 5040 | 44670 | 21.7 | 4591 | WTO |
| 1978       | 4970 | 45880 | 21.9 | 4797 | WTO |
| 1979       | 4841 | 51010 | 22.0 | 4967 | WTO |
| 1980       | 4591 | 42160 | 22.2 | 4854 | WTO |
| 1981       | 4563 | 36700 | 22.4 | 4905 | WTO |
| 1982       | 5140 | 28670 | 22.5 | 4974 | WTO |
| 1983       | 5189 | 24910 | 22.6 | 4926 | WTO |
| 1984       | 5172 | 26520 | 22.6 | 5149 | WTO |
| Senegal:   |      |       |      |      |     |
| 1974       | 27   | 387   | 4.9  | 370  | LDC |
| 1975       | 40   | 391   | 5.0  | 391  | LDC |
| 1976       | 60   | 435   | 5.1  | 423  | LDC |
| 1977       | 73   | 445   | 5.3  | 393  | LDC |
| 1978       | 76   | 389   | 5.4  | 354  | LDC |
| 1979       | 76   | 420   | 5.6  | 379  | LDC |
| 1980       | 83   | 500   | 5.8  | 354  | LDC |
| 1981       | 64   | 547   | 5.9  | 338  | LDC |
| 1982       | 65   | 665   | 6.1  | 378  | LDC |
| 1983       | 64   | 661   | 6.3  | 370  | LDC |
| 1984       | 61   | 732   | 6.5  | 339  | LDC |
| Singapore: |      |       |      |      |     |
| 1974       | 389  | 1745  | 2.2  | 3768 | LDC |
| 1975       | 446  | 2200  | 2.3  | 4013 | LDC |
| 1976       | 523  | 2298  | 2.3  | 4191 | LDC |
| 1977       | 637  | 2500  | 2.3  | 4435 | LDC |
| 1978       | 606  | 2631  | 2.4  | 4826 | LDC |
| 1979       | 604  | 2857  | 2.4  | 5181 | LDC |
| 1980       | 704  | 3378  | 2.4  | 5458 | LDC |
| 1981       | 785  | 4451  | 2.4  | 5939 | LDC |
| 1982       | 809  | 4521  | 2.5  | 6285 | LDC |
| 1983       | 724  | 5232  | 2.5  | 6772 | LDC |
| 1984       | 982  | 4693  | 2.5  | 7355 | LDC |

| YR            | ME     | GE     | POP   | PI   | BK  |
|---------------|--------|--------|-------|------|-----|
| <hr/>         |        |        |       |      |     |
| Somalia:      |        |        |       |      |     |
| 1974          | 47     | 223    | 4.0   | 253  | LDC |
| 1975          | 44     | 211    | 4.1   | 320  | LDC |
| 1976          | 43     | 213    | 4.2   | 309  | LDC |
| 1977          | 47     | 289    | 4.3   | 342  | LDC |
| 1978          | 101    | 413    | 4.7   | 341  | LDC |
| 1979          | 94     | 551    | 5.2   | 269  | LDC |
| 1980          | 79     | 426    | 6.1   | 218  | LDC |
| 1981          | 76     | 305    | 6.7   | 212  | LDC |
| 1982          | 85     | 423    | 7.0   | 215  | LDC |
| 1983          | 82     | 363    | 7.2   | 213  | LDC |
| 1984          | 103    | 373    | 7.4   | 213  | LDC |
| South Africa: |        |        |       |      |     |
| 1974          | 1964   | 17310  | 24.9  | 2606 | LDC |
| 1975          | 2454   | 18710  | 25.5  | 2582 | LDC |
| 1976          | 3268   | 19780  | 26.1  | 2556 | LDC |
| 1977          | 3489   | 19750  | 26.7  | 2492 | LDC |
| 1978          | 3257   | 20300  | 27.4  | 2503 | LDC |
| 1979          | 3132   | 20410  | 28.0  | 2545 | LDC |
| 1980          | 3896   | 20200  | 28.7  | 2625 | LDC |
| 1981          | 3364   | 22030  | 29.4  | 2683 | LDC |
| 1982          | 2907   | 22960  | 30.2  | 2604 | LDC |
| 1983          | 3737   | 23900  | 30.9  | 2484 | LDC |
| 1984          | 3422   | 25980  | 31.7  | 2553 | LDC |
| Soviet Union: |        |        |       |      |     |
| 1974          | 207300 | 335300 | 252.1 | 6352 | WTO |
| 1975          | 210000 | 298600 | 254.5 | 6419 | WTO |
| 1976          | 217300 | 325100 | 256.8 | 6598 | WTO |
| 1977          | 220500 | 342300 | 259.0 | 6738 | WTO |
| 1978          | 225300 | 360700 | 261.3 | 6931 | WTO |
| 1979          | 231000 | 392100 | 263.4 | 6906 | WTO |
| 1980          | 237200 | 428400 | 265.5 | 6968 | WTO |
| 1981          | 238500 | 459100 | 267.7 | 6993 | WTO |
| 1982          | 242700 | 505200 | 270.0 | 7088 | WTO |
| 1983          | 247000 | 508000 | 272.5 | 7214 | WTO |
| 1984          | 251300 | 528800 | 275.0 | 7266 | WTO |

| YR         | ME   | GE   | POP  | PI   | BK  |
|------------|------|------|------|------|-----|
| <hr/>      |      |      |      |      |     |
| Sri Lanka: |      |      |      |      |     |
| 1974       | 45   | 733  | 13.4 | 239  | LDC |
| 1975       | 54   | 876  | 13.7 | 250  | LDC |
| 1976       | 50   | 969  | 13.9 | 253  | LDC |
| 1977       | 42   | 866  | 14.1 | 263  | LDC |
| 1978       | 51   | 1589 | 14.4 | 273  | LDC |
| 1979       | 64   | 1590 | 14.6 | 285  | LDC |
| 1980       | 65   | 1884 | 14.9 | 296  | LDC |
| 1981       | 58   | 1580 | 15.2 | 303  | LDC |
| 1982       | 60   | 1691 | 15.4 | 310  | LDC |
| 1983       | 75   | 1726 | 15.7 | 320  | LDC |
| 1984       | 83   | 1754 | 16.0 | 333  | LDC |
| Syria:     |      |      |      |      |     |
| 1974       | 1271 | 3533 | 7.2  | 1439 | LDC |
| 1975       | 1987 | 5861 | 7.4  | 1709 | LDC |
| 1976       | 1978 | 6550 | 7.7  | 1779 | LDC |
| 1977       | 1895 | 6457 | 7.9  | 1685 | LDC |
| 1978       | 2093 | 5865 | 8.2  | 1775 | LDC |
| 1979       | 2387 | 5877 | 8.5  | 1798 | LDC |
| 1980       | 2802 | 7827 | 8.8  | 1884 | LDC |
| 1981       | 2587 | 6858 | 9.1  | 2042 | LDC |
| 1982       | 2855 | 8286 | 9.4  | 2017 | LDC |
| 1983       | 4044 | 9863 | 9.8  | 1935 | LDC |
| 1984       | 4114 | 9873 | 10.2 | 1812 | LDC |
| Tanzania:  |      |      |      |      |     |
| 1974       | 162  | 1345 | 15.3 | 343  | LDC |
| 1975       | 209  | 1759 | 15.8 | 344  | LDC |
| 1976       | 168  | 1373 | 16.3 | 346  | LDC |
| 1977       | 179  | 1469 | 16.9 | 337  | LDC |
| 1978       | 242  | 1645 | 17.4 | 331  | LDC |
| 1979       | 543  | 2101 | 18.0 | 331  | LDC |
| 1980       | 164  | 1787 | 18.5 | 335  | LDC |
| 1981       | 202  | 1698 | 19.1 | 320  | LDC |
| 1982       | 246  | 1961 | 19.7 | 313  | LDC |
| 1983       | 229  | 1731 | 20.4 | 301  | LDC |
| 1984       | 208  | 1626 | 21.0 | 300  | LDC |

| YR                   | ME   | GE   | POP  | PI   | BK  |
|----------------------|------|------|------|------|-----|
| <hr/>                |      |      |      |      |     |
| Thailand:            |      |      |      |      |     |
| 1974                 | 591  | 2939 | 41.2 | 551  | LDC |
| 1975                 | 627  | 3650 | 42.1 | 573  | LDC |
| 1976                 | 777  | 4418 | 43.1 | 607  | LDC |
| 1977                 | 900  | 4673 | 44.1 | 636  | LDC |
| 1978                 | 1142 | 5324 | 45.0 | 679  | LDC |
| 1979                 | 1349 | 5705 | 45.9 | 698  | LDC |
| 1980                 | 1359 | 6489 | 46.9 | 722  | LDC |
| 1981                 | 1352 | 6632 | 47.8 | 742  | LDC |
| 1982                 | 1508 | 7815 | 48.8 | 754  | LDC |
| 1983                 | 1519 | 7933 | 49.7 | 786  | LDC |
| 1984                 | 1626 | 8206 | 50.6 | 814  | LDC |
| Togo:                |      |      |      |      |     |
| 1974                 | 8    | 95   | 2.2  | 291  | LDC |
| 1975                 | 11   | 173  | 2.3  | 289  | LDC |
| 1976                 | 12   | 213  | 2.3  | 276  | LDC |
| 1977                 | 42   | 309  | 2.4  | 286  | LDC |
| 1978                 | 38   | 437  | 2.4  | 308  | LDC |
| 1979                 | 18   | 335  | 2.5  | 285  | LDC |
| 1980                 | 18   | 268  | 2.6  | 312  | LDC |
| 1981                 | 19   | 264  | 2.7  | 286  | LDC |
| 1982                 | 18   | 249  | 2.8  | 266  | LDC |
| 1983                 | 16   | 240  | 2.8  | 240  | LDC |
| 1984                 | 18   | 282  | 2.9  | 237  | LDC |
| Trinidad and Tobago: |      |      |      |      |     |
| 1974                 | 12   | 1135 | 1.0  | 4458 | LDC |
| 1975                 | 13   | 1181 | 1.0  | 5110 | LDC |
| 1976                 | 35   | 1795 | 1.0  | 5762 | LDC |
| 1977                 | 34   | 1891 | 1.0  | 6076 | LDC |
| 1978                 | 46   | 2303 | 1.1  | 6610 | LDC |
| 1979                 | 59   | 2667 | 1.1  | 6519 | LDC |
| 1980                 | 41   | 2794 | 1.1  | 7213 | LDC |
| 1981                 | 50   | 3258 | 1.1  | 7225 | LDC |
| 1982                 | 149  | 4054 | 1.1  | 7211 | LDC |
| 1983                 | 227  | 5000 | 1.1  | 6607 | LDC |
| 1984                 | 183  | 3048 | 1.2  | 5839 | LDC |



| YR                    | ME   | GE   | POP  | PI    | BK  |
|-----------------------|------|------|------|-------|-----|
| <hr/>                 |      |      |      |       |     |
| Tunisia:              |      |      |      |       |     |
| 1974                  | 68   | 1320 | 5.6  | 881   | LDC |
| 1975                  | 84   | 1644 | 5.7  | 920   | LDC |
| 1976                  | 81   | 1824 | 5.9  | 957   | LDC |
| 1977                  | 86   | 2122 | 6.0  | 965   | LDC |
| 1978                  | 95   | 2294 | 6.2  | 1004  | LDC |
| 1979                  | 345  | 2550 | 6.3  | 1042  | LDC |
| 1980                  | 282  | 2546 | 6.5  | 1096  | LDC |
| 1981                  | 210  | 2674 | 6.7  | 1120  | LDC |
| 1982                  | 312  | 3112 | 6.8  | 1092  | LDC |
| 1983                  | 383  | 3407 | 6.9  | 1126  | LDC |
| 1984                  | 265  | 3543 | 7.1  | 1164  | LDC |
| Uganda:               |      |      |      |       |     |
| 1974                  | 247  | 1267 | 10.8 | 689   | LDC |
| 1975                  | 192  | 1055 | 11.1 | 642   | LDC |
| 1976                  | 187  | 1039 | 11.4 | 637   | LDC |
| 1977                  | 134  | 638  | 11.8 | 625   | LDC |
| 1978                  | 116  | 581  | 12.1 | 563   | LDC |
| 1979                  | 61   | 320  | 12.5 | 467   | LDC |
| 1980                  | 49   | 201  | 12.8 | 434   | LDC |
| 1981                  | 52   | 173  | 13.1 | 447   | LDC |
| 1982                  | 47   | 290  | 13.4 | 475   | LDC |
| 1983                  | 51   | 355  | 13.8 | 483   | LDC |
| 1984                  | 75   | 453  | 14.2 | 494   | LDC |
| United Arab Emirates: |      |      |      |       |     |
| 1974                  | 41   | 382  | 0.4  | 33050 | LDC |
| 1975                  | 59   | 559  | 0.5  | 32110 | LDC |
| 1976                  | 139  | 1115 | 0.6  | 33750 | LDC |
| 1977                  | 810  | 2606 | 0.7  | 34940 | LDC |
| 1978                  | 1172 | 2908 | 0.8  | 27040 | LDC |
| 1979                  | 1580 | 3114 | 0.9  | 29800 | LDC |
| 1980                  | 2087 | 5046 | 1.0  | 34030 | LDC |
| 1981                  | 2340 | 6132 | 1.1  | 32290 | LDC |
| 1982                  | 2071 | 6342 | 1.2  | 26650 | LDC |
| 1983                  | 1973 | 5135 | 1.2  | 22220 | LDC |
| 1984                  | 1868 | 4652 | 1.2  | 20300 | LDC |

| YR          | ME   | GE    | POP  | PI   | BK  |
|-------------|------|-------|------|------|-----|
| <hr/>       |      |       |      |      |     |
| Uruguay:    |      |       |      |      |     |
| 1974        | 132  | 1122  | 2.8  | 1625 | LDC |
| 1975        | 133  | 1144  | 2.8  | 1709 | LDC |
| 1976        | 112  | 1248  | 2.9  | 1772 | LDC |
| 1977        | 121  | 1255  | 2.9  | 1797 | LDC |
| 1978        | 123  | 1274  | 2.9  | 1878 | LDC |
| 1979        | 137  | 1228  | 2.9  | 2001 | LDC |
| 1980        | 180  | 1366  | 2.9  | 2108 | LDC |
| 1981        | 244  | 1584  | 2.9  | 2153 | LDC |
| 1982        | 228  | 1727  | 2.9  | 1916 | LDC |
| 1983        | 170  | 1373  | 2.9  | 1739 | LDC |
| 1984        | 139  | 1280  | 2.9  | 1663 | LDC |
| Venezuela:  |      |       |      |      |     |
| 1974        | 987  | 20360 | 12.2 | 4558 | LDC |
| 1975        | 1172 | 20710 | 12.7 | 4781 | LDC |
| 1976        | 928  | 21270 | 13.1 | 4997 | LDC |
| 1977        | 1087 | 22330 | 13.6 | 5137 | LDC |
| 1978        | 1131 | 21060 | 14.1 | 5105 | LDC |
| 1979        | 1036 | 16320 | 14.6 | 4974 | LDC |
| 1980        | 903  | 18590 | 15.0 | 4694 | LDC |
| 1981        | 807  | 25150 | 15.5 | 4519 | LDC |
| 1982        | 1196 | 23470 | 15.9 | 4337 | LDC |
| 1983        | 995  | 19150 | 16.4 | 3984 | LDC |
| 1984        | 1031 | 18170 | 16.9 | 3822 | LDC |
| Yugoslavia: |      |       |      |      |     |
| 1974        | 1733 | 8201  | 21.2 | 1675 | LDC |
| 1975        | 1891 | 8206  | 21.3 | 1671 | LDC |
| 1976        | 1804 | 8834  | 21.6 | 1740 | LDC |
| 1977        | 1859 | 4339  | 21.8 | 1873 | LDC |
| 1978        | 1845 | 4137  | 21.9 | 2013 | LDC |
| 1979        | 1975 | 4360  | 22.1 | 2098 | LDC |
| 1980        | 2013 | 4147  | 22.3 | 2108 | LDC |
| 1981        | 1942 | 3850  | 22.5 | 2108 | LDC |
| 1982        | 1785 | 3558  | 22.6 | 2116 | LDC |
| 1983        | 1665 | 3582  | 22.8 | 2052 | LDC |
| 1984        | 1731 | 3478  | 23.0 | 2071 | LDC |

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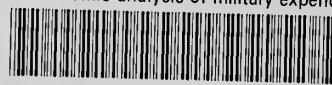
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